Northwest

Submittal

Batelle BSF / CSF Building

Our energy working for you™

Cummins Northwest, LLC
Washington, Oregon, Alaska & Montana

Powerful Solutions. Dependable Support. Every Time

March 2, 2009

SUBMITTAL

TO

MAGNUM ELECTRIC SERVICE, INC.

FOR

BATTELLE BSF / CSF BUILDING

CUMMINS POWER GENERATION GENERATOR SET
Model:
500 DFEK

CUMMINS AUTOMATIC TRANSFER SWITCHES: POWER COMMAND
Model:
OTPC 300
Quantity 2

Model:
OTPC 600
Quantity 1

Project #31508

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cumminsnorthwest.com

Service Locations: Alaska - Anchorge; Montana - Missoula;
Oregon - Coburg, Medford, Pendleton, Portland, Portland Distribution Center;
Washington - Chehalis, Renton, Spokane, Yakima

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BILL OF MATERIALS & SPECIFICATIONS

Battelle BSF/CSF Bldg

Cummins Diesel Generator Set
Model 500 DFEK

KW: 500 Hertz: 60 Phase: 3 Voltage: 277/480

Equipped with but not limited to the following:

- Genset-Diesel,60Hz,500kW-Standby Rating
- Duty Rating-Standby Power
- Listing-UL 2200
- Emissions-Certified, EPA, Tier 2,Non Road Compression Ignition
- Voltage-277/480,3 Phase,Wye,4 Wire
- Alternator-60Hz,12 Lead, Extended Range,105C
- Set Control-PCC, Basic, No Alpha/Analog Display
- Paralleling-Isolated Bus, Automatic
- Display Language-English
- Display-Control, Graphical
- Meters-AC Output, Analog
- Shutdown Alarm Relay-3 Pole Double Throw
- Run Relays-Three 3 Pole Double Throw
- Alarm-Audible, Engine Shutdown
- Interface-Communications Network,FTT-10
- Control Mounting-Left Facing
- Circuit Breaker Mounting-Single Breaker, Right of Control
- Circuit Breaker-1200 AF/800 AT, 3 Pole, UL 600,IEC 415
- Indication-Ground Fault
- Auxiliary contacts/Trip alarm-Single Circuit Breaker
- Shunttrip-24vdc,Single Circuit Breaker
- Separator-Fuel/Water
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- Coolant Heater-208/240/480V, Below 40F Ambient Temp
- Engine Air Cleaner-Normal Duty
- Exhaust Connector-ASA Flange
- Test Record-Various
- Test-Extended, Standby Load, 4 Hour
- Test-Independent Laboratory

- Genset Warranty-2 Year Standby

Cummins Automatic Transfer Switch – PowerCommand
Model OTPC 300 QTY 2
ATS – 1 and ATS – 3

Amps: 300 Voltage: 480 Poles: 4

Equipped with but not limited to the following:

- Transfer Switch-Power Command,300 Amp
- Poles-4
- Application-Utility To Genset
- Listing-UL 1008/CSA Certification
- Certification-Seismic ATS
- Frequency-60 Hertz
- System-3 Phase,3 Wire Or 4 Wire
- Voltage-480 Vac
- Cabinet-Type 1
- Control-Transfer Switch, Level 2
- Display-Digital
- Module-Relay Signal
- Interface-Communications Network,FTT-10
- Auxiliary Relay-Switch In Emergency Position-24VDC
- Auxiliary Relay-Switch In Normal Position-24VDC
- Load Shed-From Emergency
- Transfer Switch Warranty-2 Year Comprehensive

Cummins Automatic Transfer Switch – PowerCommand
Model OTPC 600 QTY 1
ATS – 2
Amps: 600 Voltage: 480 Poles: 4

Equipped with but not limited to the following:

- Transfer Switch-Power Command, 600 Amp
- Poles-4
- Application-Utility To Genset
- Listing-UL 1008/CSA Certification

- Certification-Seismic ATS
- Frequency-60 Hertz
- System-3 Phase,3 Wire Or 4 Wire
- Voltage-480 Vac
- Cabinet-Type 1
- Control-Transfer Switch, Level 2
- Display-Digital
- Module-Relay Signal
- Interface-Communications Network, FTT-10
- Auxiliary Relay-Switch In Emergency Position-24VDC
- Auxiliary Relay-Switch In Normal Position-24VDC
- Load Shed-From Emergency
- Transfer Switch Warranty-2 Year Comprehensive

Also Included

- Custom Sound Enclosure
    - (75dba @ 23 ft) with lighting and power distribution panel
- 300 Gallon DW sub-base fuel accessories specified
- Load Shed Control
- Annunciator Kit with Enclosure – Qty 5
- Seismic Spring Isolators – Qty 6
- Seismic Calculations
- 10A Battery Charger
- Group 8D Battery – Qty 2
- Operation & Maintenance Manuals – Qty 4
- Startup and 4hr Load Bank Testing
- Training -up to 4hrs
- Inbound Freight

Cummins Northwest, LLC

Attachment to Quotation
-Exclusions-

Fuel System:	Fuel for testing and initial fill of fuel.
Electrical:	All off-engine wiring, field terminations of wiring, and lugs other than those detailed in our submittal.
Mounting:	Generator mounting bolts and anchors.
Miscellaneous:	Third party electrical testing and certification, seismic certifications/calculations for generator isolators only, coordination studies, stamped engineering calculations, emissions testing, all other services and material not specifically listed in the preceding quotation.
Documentation:	Unless stated otherwise, four sets of O & M manuals are available upon request. Electronic manuals are not available.
Taxes and Permits:	Any applicable sales tax, permits, licenses.

All items listed are excluded and will only be supplied by Cummins Northwest, LLC if agreed upon, in writing, by a sales representative for Cummins Northwest, LLC.

Clarifications/Exceptions to Specifications: 263213 1.05K Cummins will assist the Contractor with information needed to complete air quality permit. 1.05C & 2.02B 500 DFEK max output per prototype testing is 516kw including all reserve factors. 2.10B 2 Circuit Breaker provided is a Square D, PJ Series 1200AF/800AT, with ground fault indication only (no trip). 2.09D Load shed control provided will be current sensing, rather than voltage sensing. 2.12 Pre-fitted enclosure sound hoods are shipped separate, to be re-installed by Contractor at jobsite. 2.14 H. ATS-1 & 3 are oversized to meet drawing withstand ratings. 2.10 I. In-line current limiting fuse protection is not provided within ATS's. 2.10 G. Transfer switches are provided in Nema 1 enclosures stand-alone, not designed for bus connection into a switchboard.

Current factory lead time is 13-15 weeks after drawing approvals.

-Terms and Conditions-

- This offer and quotation incorporates and is contingent upon acceptance of the terms and conditions in the standard Sales Order of Cummins Northwest, LLC. Purchase Orders or other documents with terms and conditions that are inconsistent with the CNW standard Sales Order will not be accepted unless agreed to in writing by an officer of Cummins Northwest, LLC.
- **Prices are valid for 30 days**
- If included in the quotation, all on-site startup, testing and training assumes weekdays, during standard CNW business hours. **Additional charges may be added for work requested to be done on overtime, weekends, and holidays.**
- **F.O.B. factory, freight allowed to jobsite, off-loading is not included**
- Factory direct shipments require credit approval prior to shipment
- Terms are C.O.D. or net 30 days ***upon approval of credit***
- Equipment held for longer than 30 days may be charged a monthly storage fee
- Cancellation charges are 25% ***minimum*** after release of order

Cummins Northwest, LLC
811 SW Grady Way
Renton, WA 97801
(800)274903360 fax: (425)235-8202

GENERATOR START-UP CHECK LIST

Please fill out this form accurately. If the equipment is not ready for start-up and testing, the installer will be responsible for all costs associated with the initial site visit. Start-up services will not be performed by Cummins Northwest, unless this form is returned a minimum of two business days before scheduled start-up.

Please review your installation and respond to the check list below:

Return to: _____ Checklist Completed by: _____
Phone: _____ Company: _____
Fax: _____ Date Sent: _____
Requested Date for Start-Up: _____ Phone #: _____
Project Name / #: _____ Fax #: _____

	YES	NO
*1. Utility power available and connected to ATS / MTS (Don't connect door plug to harness)		
2. Owner / Tenant has been notified of the start-up date.		
3. Can emergency loads be transferred to generator at start-up?		
*4. Generator mainline circuit breaker connected to ATS / MTS		
*5. Remote start wires terminated at generator and ATS.		
*6. Remote annunciator wires terminated at generator and ATS.		
7. Fuel supply connected to engine with approved flexible lines.		
8. Fuel available on-site and ready for testing.		
9. Natural Gas and / or Propane plumbing completed in accordance with manual.		
10. Propane tank set up for liquid _____ or vapor _____ withdrawal.		
11. Exhaust system installation complete including all piping and insulation.		
*12. Fuel day tank power connected. (Do Not Energize Circuit)		
13. Remote radiator, piping, expansion tanks installed flushed, filled with coolant.		
*14. Engine coolant heater connected to utility (Do Not Energize Circuit)		
15. Generator and isolators mounted to pad properly.		
16. Radiator discharge air exhaust duct installed.		
17. Intake and exhaust louvers installed and operational.		
18. Generator battery / batteries on site. (Do Not Energize Circuit)		
*19. Battery charger power connected (Do Not Energize Circuit)		
20. Other: _____		

Interconnect Wiring:
All interconnect wiring must be installed per Cummins Power Generation interconnect wiring drawing recommendations.

Fuel Plumbing:
Recommended fuel line material for diesel systems is schedule 40 black iron pipe.

Exhaust Piping:
Recommended exhaust pipe material is schedule 40 black iron pipe.

***** Items **1**, **4**, **5**, **6**, **12**, **14 & 19** - **Referenced wiring must be terminated without exception**. CNI is not allowed by ***RCW 19.28*** , ***WAC 296-46A*** & **WAC 296-401B** to initially terminate this wiring. Once terminated, CNI can change or correct the wiring.

Commercial Worldwide Warranty

Commercial
Generator Set
Transfer Switch
Switchgear

Power Generation

Limited Warranty

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Base Coverage

Coverage Period

Commercial Generator Set and Transfer Switch

This is a limited warranty that applies to all Cummins Power Generation® brand Commercial Generator Sets and associated Accessories (hereinafter referred to as "Product"). Product will be free from defects in material and workmanship for a period of one (1) year from the date of "in service" or 18 months from shipment (24 months for permanently installed equipment) to the first end user, whichever comes first. (Permanently installed is defined as Product installed and intended to remain in place for its lifetime, for example, where a generator set must be installed in a building during the early stages of construction. This does not include applications such as a generator set mounted on a concrete slab and hooked up to a building.)

Commercial Switchgear

This is a limited warranty, which applies to all Cummins Power Generation® brands Switchgear and associated Accessories (hereinafter referred to as "Product"). Product will be free from defects in material and workmanship for a period of one year from the date of "in service" or 18 months from shipment to the first end user, whichever comes first.

All Commercial Product

Repair or replacement parts are warranted for ninety (90) days from the date of purchase, excluding labor and travel expenses except in those cases where the end user has paid these expenses for a previous repair. Non-Cummins Power Generation accessories are not covered under this warranty.

In the case of Product used for rental or demonstration purposes, the base coverage period begins on the date the Product is first used for such rental or demonstration purposes. This warranty is extended to all subsequent owners of the Product during the coverage period. Said coverage shall include parts, labor, travel expenses and labor to remove/reinstall said Product. See your Distributor for details.

Cummins Power Generation Responsibilities

Cummins Power Generation's liability and owner's sole remedy are limited to the repair or replacement, at Cummins Power Generation's option, of the Product or parts that do not conform to this warranty. In accordance with Cummins Power Generation's Warranty Administration policies, Cummins Power Generation will pay for the parts and labor required to repair the Product and, when necessary, reasonable labor expenses associated with the removal and reinstallation of the Product if such work is done by an authorized Cummins Power Generation /Onan Distributor or designated service representative.

In accordance with Cummins Power Generation's Warranty Administration policies, Cummins Power Generation will pay limited travel expenses (excludes mobile applications) for generator sets 20 kW and above, transfer switches and switchgear total round trip is limited to 500 miles (800km) and 11 hours travel time and for generator sets below 20 kW total round trip is limited to 100 miles (160 km) and 2.5 hours travel time when necessary to make on-site repairs. The cost of maintenance items such as oil, filter elements, belts, hoses, starting batteries and light bulbs will be paid for by Cummins Power Generation when such items are not reusable because of the warrantable failure.

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Owner's Responsibilities

The owner is obligated to install, operate and maintain the Product in accordance with the recommendations published by Cummins Power Generation, including, without limitation, operating within power rating designation set out in Power Rating section for generator sets, below. The owner is responsible for the costs associated with such maintenance. The owner is responsible for any adjustments which may be required beyond 90 days from the in service date.

Prior to expiration of the applicable warranty and within 30 days after discovery of the warrantable failure, the owner must notify an authorized Cummins Power Generation/Onan Distributor or designated repair facility of any warrantable failure and have the repair or replacement made by such facility. Installation inspection and initial start-up of Commercial Product must be conducted by an authorized Cummins Power Generation/Onan distributor or designated representative.

The owner is responsible for payment of any of the following expenses that might be incurred as a result of a failure under the terms of this warranty:

1. Rental equipment used to replace the Product being repaired, other downtime expenses, and all business costs and losses.
2. Telephone, communication, living and travel expenses incurred by the owner.
3. The premium costs for overtime labor requested by the owner.
4. The cost of airfreight or other extraordinary expenses for shipment of parts over and above premium surface transportation.
5. Any other consequential or incidental amounts.

Under Comprehensive Extended Coverage, owner responsibilities are identical to those noted under the Base Warranty.

Under Basic Extended Coverage, the owner is responsible for all expenses beyond the Base Warranty period except the cost of the failed warrantable part and the labor to remove/replace such failed part through the second year, as specified in the Base Warranty.

Under Major Components Extended Coverage, the owner responsibilities are identical to those listed under Basic Extended Coverage up to year 5 or 1500 hours, whichever occurs first. In years 6 through 10 or hours exceeding 1500, up to 3000, the owner is responsible for all expenses except the cost of the failed warrantable major component as specified under Cummins Power Generation's Responsibilities.

Under Prime Power Extended Coverage, the owner is responsible for all expenses beyond the Base Warranty period except the cost of the failed warrantable part and the labor to remove/replace such failed part as specified in the Base Warranty.

For all Extended Coverage programs, the owner is responsible for providing written documentation showing that the product has been maintained in accordance with Cummins Power Generation's published recommendations.

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Power Ratings

Cummins Power Generation **generator sets must be applied within the following rating designations:**

Standby Power Rating

The standby power rating is applicable for supplying emergency power for the duration of normal power interruption.

No sustained overload capability is available for this rating. This rating is applicable to installations served by a reliable normal utility source. This rating is only applicable to variable loads with an average load factor of 80% of the standby rating for a maximum of 200 hours of operation per year. In installations served by unreliable utility sources (where outages last longer or occur more frequently), where operation is likely to exceed 200 hours per year, the prime power rating should be applied. The standby rating is only applicable for emergency and standby applications where the generator set serves as the back-up to the normal utility source. No sustained utility parallel operation is permitted with this rating. For applications requiring sustained utility parallel operation, the prime power or base load rating must be utilized.

Prime Power Rating

The prime power rating is applicable for supplying electric power in lieu of commercially purchased power as set out below.

The number of allowable operating hours per year is unlimited for variable load applications but is limited for constant load applications as described below:

Unlimited Running Time Power

Prime power is available for an unlimited number of annual operating hours in variable load applications. Applications requiring any utility parallel operation at constant load are subject to running time limitations. In variable load applications, the average load factor should not exceed 70% of the prime power rating. A 10% overload capability is available for a period of one hour within a twelve hour period of operation, but not to exceed 25 hours per year. The operating time at or above the Prime Power Rating must not exceed 500 hours per year.

Limited Running Time Prime Power

Prime power is available for a limited number of annual operating hours in constant load applications such as interruptible, load curtailment, peak shaving and other applications that normally involve utility parallel operation. Generator sets may operate in parallel with the utility source up to 750 hours per year at power levels not to exceed the Prime Power Rating. Any application requiring more than 750 hours of operation per year at the Prime Power Rating should use the Base Load Power Rating.

Base Load Power Rating

The base load power rating is applicable for supplying power continuously to a load up to 100% of the base rating for unlimited hours.

No sustained overload capability is available at this rating. This rating is applicable for utility base load operation. In these applications, generator sets are operated in parallel with a utility source and run under constant loads for extended periods of time.

Note: In determining average load factor, loads of less than 30% are considered as 30% and time at standstill is not counted.

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Limitations
Cummins Power Generation is not responsible for the repair or replacement of Product required because of normal wear, accident, misuse, abuse, improper installation (such as installing a generator set designed for stationery use in a mobile application), lack of maintenance, unauthorized modifications, improper storage, negligence, improper or contaminated fuel, or use of parts that do not meet Cummins Power Generation specifications.

Generator set warranty will not cover any failures associate with Battle Short Mode applications.

Extended Coverage options for Standby Applications apply only to Cummins Power Generation brand Generator Sets, Transfer Switches, Switchgear and associated Accessories used exclusively in emergency standby power applications. 10 year Extended Coverage applies only to Cummins Power Generation brand diesel gensets rated 200 kW/60 Hz and above.

Extended Coverage options for Utility Load Management Applications apply only to Cummins Power Generation brand diesel Generator Sets, Transfer Switches, Switchgear and associated Accessories rated at 200 kW/60 Hz and above used exclusively in Utility Load Management Applications.

2 year Prime Power Extended Coverage applies only to Cummins Power Generation brand diesel Generator Sets, Transfer Switches, Switchgear and associated Accessories, including set mounted controls.

All Commercial Product must be registered within the Base Warranty period. If this requirement is not followed, a penalty charge will apply. See your Cummins Power Generation Distributor for details.

If you have any questions regarding your warranty rights and responsibilities, you should contact your Cummins Power Generation/Onan distributor by calling 1-800-888-6626.

NORMAL WEAR**:**
This warranty will not cover repair where normal use has exhausted the life of a part or Product. All mechanical devices need periodic parts replacement and service to perform well.
It should be remembered that the service life of any product is dependent on the care it receives and the conditions under which it has to operate.

Coolant heaters will be covered for a period of one year from date of start-up. This warranty shall not apply to starting batteries. Steel enclosures are warranted for one year only and are not covered by any extended warranty option. The use of aluminum generator set enclosures and skirts, whenever offered by CPGF is the proper installation practice for generator sets in outdoor applications in coastal regions, defined as locations 60 miles and closer to bodies of saltwater.

THERE IS NO OTHER EXPRESS WARRANTY, AND NO PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTIES OR TO ASSUME ANY OTHER LIABILITIES ON CUMMINS POWER GENERATION'S BEHALF UNLESS MADE OR ASSUMED IN WRITING BY AN OFFICER OF CUMMINS POWER GENERATION.

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IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED TO THE PERIODS OF COVERAGE SET FORTH ABOVE. TO THE EXTENT PERMITTED BY LAW, ANY AND ALL IMPLIED WARRANTIES ARE EXCLUDED. IN NO EVENT IS CUMMINS POWER GENERATION LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This warranty gives the owner specific legal rights. The owner may also have other rights which vary depending on local laws. In some areas, local laws do not allow limitations on how long an implied warranty lasts or do not allow the exclusion of incidental or consequential damages, so the above limitations may not apply to you.

Extended Coverage

Features

Several levels of Extended Coverage are available on Commercial Products. Basic, Comprehensive, Major Components, Prime Power and Utility Load Management.

Extended Coverage programs are available only in the United States and Canada. Extended coverage must be registered within the base warranty of the product. Cummins Power Generation provides total system coverage for all Commercial Product and associated Accessories. There are NO deductibles applied to these programs.

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CPGF COMMERCIAL WARRANTY PROGRAM COVERAGE SUMMARY

Warranty Program	Base Warranty	Comprehensive Extended Coverage	Basic Extended Coverage	Comprehensive Extended Coverage	Prime Power Extended Coverage	Major Components Extended Coverage****
Generator Set Sales Feature	L028	L029	L030	L031	L040	L041
Generator Set Warranty I.D. Number	1	16	17	18	20	19
Transfer Switch Sales Feature	G002-7	G004-7	G006-7	G007-7	N/A	G008-7
Switchgear Sales Feature	RFQ	RFQ	RFQ	RFQ	RFQ	RFQ
Warranty Application Code	All	ST	ST	ST	PR	ST
Years from "Date In Service"	1	2	5	5	2	10
Hours Covered	Unlimited	1500 Hours	1500 Hours	1500 Hours	6000 Hours	3000 Hours
Labor	Standard	Standard	Through 2nd year only	Standard	Standard	Through 2nd Year only
Months from Shipment to End User	18/24 Months***	30/36 Months***	60/66 Months***	60/66 Months***	30/36 Months***	120/126 Months***
Maximum Round Trip Travel/Mileage	500 Miles (800km) and 11 hours *	500 Miles (800km) and 11 hours*	First year only*	500 Miles (800km) and 11 hours*	First year only*	First year only*
Meals/Lodging	Reasonable**	Reasonable**	First year only	Reasonable**	First year only	First year only
Maintenance Items	Loss due to failure	Loss due to failure	Loss due to failure	Loss due to failure	Loss due to failure	Loss due to failure
Unit Remove/ Reinstall	Covered	Covered	First year only	Covered	First year only	First year only
Regions Covered	World Wide	US/Canada	US/Canada	US/Canada	US/Canada	US/Canada
Deductibles	None	None	None	None	None	None
Product Covered	Genset or Transfer Switch or Switchgear	Genset or Transfer Switch or Switchgear	Genset or Transfer Switch or Switchgear	Genset or Transfer Switch or Switchgear	Genset or Transfer Switch or Switchgear	Diesel, Genset or Transfer Sw Switchgear

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CPGF COMMERCIAL WARRANTY PROGRAM COVERAGE SUMMARY Cont..

WARRANTY PROGRAM	Utility Load Management Basic Extended Coverage	Utility Load Management Comprehensive Extended Coverage
Generator Set Sales Feature	L054	L055
Generator Set Warranty I.D. Number	22	23
Transfer Switch Sales Feature	N/A	N/A
Switchgear Sales Feature	RFQ	RFQ
Warranty Application Code	UT	UT
Years from "Date In Service:	5 Years	5 Years
Hours Covered Years/Hours	4000 Hours	4000 Hours
Labor	Through 2nd year only	Standard
Months from Shipment to End User	60/66 Months***	60/66 Months***
Maximum Round Trip Travel/Mileage	First year only	500 Miles (800km) and 11 hours
Meals/Lodging	First year only**	Reasonable**
Maintenance Items	Loss due to failure	Loss due to failure
Unit Remove/Reinstall	First year only	Covered
Deductibles	None	None
Product Covered	200+ kW Diesel Genset or Transfer Switch or Switchgear	200+ kW Diesel Genset or Transfer Switch or Switchgear
Region Covered	U.S. and Canada only	U.S. and Canada only

CPGF COMMERCIAL WARRANTY PROGRAM COVERAGE SUMMARY KEY

* Below 20kw 100 miles (160km) and 2.5 hour maximum

** Combination of 10 hours of travel/labor during one trip for meals and lodging to be allowed

*** Warranty coverage is extended an additional 6 months for all permanently installed generator set or transfer switch. Permanently installed is defined as Product installed and intended to remain in place for its lifetime, for example, where a generator set must be installed in a building during the early stages of construction. This does not include applications such as a generator set mounted on a concrete slab and hooked up to a building. This does not apply to switchgear.

**** Major Components Extended Coverage provides only replacement parts for the following major components: Engines-Cylinder block, camshaft, crankshaft, connecting rods, and flywheel; Alternator-main rotor, main stator and drive disc; Transfer Switch-actuator motor and main contacts; Switchgear-buswork and main circuit breaker.

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Diesel generator set QSX15 series engine EPA emissions

> Specification sheet
350 kW - 500 kW standby

Our energy working for you.™

Power Generation

Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.

The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.

All low voltage models are CSA certified to product class 4215-01.

The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage. Circuit breaker assemblies are UL 489 Listed for 100% continuous operation and also UL 869A Listed Service Equipment.

U.S. EPA Engine certified to U.S. EPA Nonroad Source Emissions Standards, 40 CFR 89, Tier 2.

Features

Cummins® heavy-duty engine - Rugged 4-cycle, industrial diesel delivers reliable power, low emissions and fast response to load changes.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Permanent magnet generator (PMG) - Offers enhanced motor starting and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard integral set-mounted radiator system, designed and tested for rated ambient temperatures, simplifies facility design requirements for rejected heat.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

Fuel tanks - Dual wall sub-base fuel tanks are also available.

NFPA - The genset accepts full rated load in a single step in accordance with NFPA 110 for Level 1 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

	Standby rating		Prime rating		Continuous rating		Data sheets	
Model	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz	50 Hz
DFEG	350 (438)		320 (400)				D-3398	
DFEH	400 (500)	352 (440)	350 (438)	320 (400)			D-3399	D-3402
DFEJ	450 (563)	400 (500)	410 (513)	364 (455)			D-3400	D-3403
DFEK	500 (625)	440 (550)	455 (569)	400 (500)			D-3401	D-3404

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S-1582a (9/08)

Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G3
Voltage regulation, no load to full load	± 0.5%
Random voltage variation	± 0.25%
Frequency regulation	Isochronous
Random frequency variation	± 0.25%
Radio frequency emissions compliance	IEC 801.2, Level 4 electrostatic discharge IEC 801.3; Level 3 radiated susceptibility

Engine specifications

Design	Turbocharged with air-to-air charge air cooling
Bore	136.9 mm (5.39 in)
Stroke	168.9 mm (6.65 in)
Displacement	14.9 L (912.0 in^3)
Configuration	Cast iron with replaceable wet liners, in-line 6 cylinder
Battery capacity	900 amps minimum at ambient temperature of 0 °C (32 °F)
Battery charging alternator	35 amps
Starting voltage	24 volt, negative ground
Fuel system	Full authority electronic (FAE) Cummins HPI-TP
Fuel filter	
Air cleaner type	
Lube oil filter type(s)	Single spin-on combination full flow and bypass filters
Standard cooling system	40 °C (104 °F) ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof revolving field
Stator	2/3 pitch
Rotor	Single bearing, flexible discs
Insulation system	Class H
Standard temperature rise	125 ºC standby at 40 °C ambient
Exciter type	PMG (Permanent magnet generator)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz line–neutral/line-line

- 110/190
- 110/220
- 115/200
- 115/230
- 120/208
- 127/220
- 139/240
- 220/380
- 230/400
- 240/416
- 255/440
- 277/480
- 347/600

50 Hz line–neutral/line-line

- 110/190
- 110/220
- 115/200
- 115/230
- 120/208
- 127/220
- 139/240
- 220/380
- 230/400
- 240/415
- 255/440

Note: Consult factory for other voltages.

Generator set options and accessories

Engine

- ☐ 208/240/480 V thermostatically controlled coolant heater for ambient above 4.5 °C (40 °F)
- ☒ 208/240/480 V thermostatically controlled coolant heater for ambient below 4.5 °C (40 °F)
- ☐ 120 V 300 W lube oil heater
- ☐ Heavy duty air cleaner with safety element

Alternator

- ☐ 80 °C rise
- ☒ 105 °C rise
- ☐ 150 °C rise
- ☐ 120/240 V 300 W anti-condensation heater

Exhaust system

- ☐ Critical grade exhaust silencer
- ☐ Exhaust packages
- ☐ Industrial grade exhaust silencer
- ☐ Residential grade exhaust silencer

Fuel system - 60 Hz

- ☐ 1136 L (300 gal) sub-base tank
- ☐ 1514 L (400 gal) sub-base tank
- ☐ 1893 L (500 gal) sub-base tank
- ☐ 2271 L (600 gal) sub-base tank
- ☐ 2498 L (660 gal) sub-base tank
- ☐ 3218 L (850 gal) sub-base tank
- ☐ 6435 L (1700 gal) sub-base tank

Fuel system - 50 Hz

- ☐ 155 L (41 gal) in-skid day tank (dual wall)
- ☐ 208 L (55 gal) in-skid day tank (single wall)
- ☐ 1595 L (425 gal) sub-base tank
- ☐ 3191 L (850 gal) sub-base tank

Cooling system

- ☒ High ambient 50 °C radiator

Control panel

- ☐ 120/240 V 100 W control anti-condensation heater
- ☒ Ground fault indication
- ☐ Power transfer control
- ☐ Remote fault signal package
- ☒ Run relay package

Generator set

- ☐ AC entrance box
- ☒ Battery -Interstate
- ☒ Battery charger -SENS
- ☐ Export box packaging
- ☒ UL 2200 Listed
- ☒ Main line circuit breaker
- ☒ Paralleling accessories
- ☒ Remote annunciator panel
- ☒ Spring isolators -CalDyn
- ☐ Enclosure: aluminum, steel, weather protective or sound attenuated
- ☒ 2 year standby power warranty
- ☐ 2 year prime power warranty
- ☐ 5 year basic power warranty
- ☐ 10 year major components warranty

Note: Some options may not be available on all models - consult factory for availability.

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Power Generation

Control system PCC 2100 or PCC 3201

PowerCommand control is an integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions. Major features include:

- Integral AmpSentry™ Protective Relay providing a full range of alternator protection functions that are matched to the alternator provided.
- Battery monitoring and testing features and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Standard PCCNet™ and optional Echelon® LONWORKS® network interface.
- Control suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 meters (13,000 feet).
- Prototype tested; UL, CSA, and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics.

Operator/display panel

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp test switch
- Emergency stop switch
- Alpha-numeric display with pushbutton access for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating genset running, not in auto, common warning, common shutdown
- Configurable for local language

Engine protection

- Overspeed shut down
- Low oil pressure warning and shut down
- High coolant temperature warning and shut down
- High oil temperature warning (some models)
- Low coolant level warning or shut down
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shut down
- Fail to start (overcrank) shut down
- Fail to crank shut down
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Engine data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature (some models)
- Engine speed

AmpSentry AC protection

- Over current and short-circuit shut down
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shut down
- Over and under frequency shut down
- Overload warning with alarm contact
- Reverse power and reverse Var shut down
- Excitation fault

Alternator data

- Line-to-line and line-to-neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase power factor, kW and kVA

Other data

- Genset model data
- Start attempts, starts, running hours
- kW hours (total and since reset)
- Fault history

Governing

- Digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode
- Glow plug control (some models)

Voltage regulation

- Digital PWM electronic voltage regulation
- Three phase line-to-neutral sensing
- Suitable for PMG or shunt excitation
- Single and three phase fault regulation
- Configurable torque matching

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- Configurable customer inputs (4)
- Configurable customer outputs (4)
- Configurable network inputs (8) and outputs (16) (with optional network)
- Remote emergency stop

Paralleling (Option)

- Active digital phase lock loop synchronizer
- Isochronous kW and kVar load sharing controls
- kW import/export and kVar/PF control for utility (mains) paralleling

Options

- ☑ PCC 3201 paralleling control
- ☑ LED bargraph AC data display
- ☐ Thermostatically controlled space heater
- ☐ Key-type mode switch
- ☑ Ground fault module
- ☑ Auxiliary relays (3)
- ☑ Echelon LONWORKS interface
- ☐ Modion Gateway to convert to Modbus (loose)
- ☐ PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- ☐ Digital input and output module(s) (loose)
- ☑ Remote annunciator (loose)

For further detail on PCC 2100 see document S-1409.
For further detail on PCC 3201 see document S-1444.

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Power Generation

Ratings definitions

Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

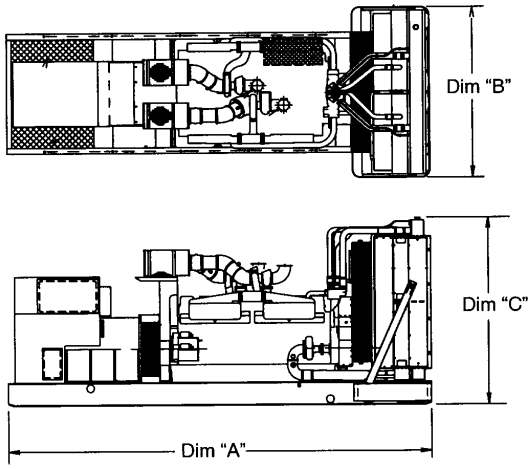
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
DFEG	3864 (152.1)	1524 (60.0)	1812 (71.3)	3856 (8500)	3992 (8800)
DFEH	3864 (152.1)	1524 (60.0)	1812 (71.3)	3856 (8500)	3992 (8800)
DFEJ	3864 (152.1)	1524 (60.0)	1812 (71.3)	4082 (9000)	4218 (9300)
DFEK	3864 (152.1)	1524 (60.0)	1812 (71.3)	4309 (9500)	4445 (9800)

* Weights represent a set with standard features. See outline drawings for weights of other configurations.

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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Power Generation

Model: DFEK
Frequency: 60
Fuel type: Diesel
KW rating: 500 standby
455 prime

Generator set data sheet

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Exhaust emission data sheet:	**EDS-173**
Exhaust emission compliance sheet:	**EPA-1005**
Sound performance data sheet:	**MSP-177**
Cooling performance data sheet:	**MCP-105**
Prototype test summary data sheet:	**PTS-145**
Standard set-mounted radiator cooling outline:	**0500-3326**
Optional set-mounted radiator cooling outline:	
Optional heat exchanger cooling outline:	
Optional remote radiator cooling outline:	

Fuel consumption

	Standby kW (kVA)				Prime kW (kVA)				Continuous kW (kVA)
Ratings	500 (625)				455 (569)				
Load	**1/4**	**1/2**	**3/4**	**Full**	**1/4**	**1/2**	**3/4**	**Full**	**Full**
US gph	11.6	18.8	25.7	34.4	10.9	17.6	23.7	30.4	
L/hr	44	71	97	130	41	67	90	115	

Engine

	Standby rating	Prime rating	Continuous rating
Engine manufacturer	Cummins Inc.		
Engine model	QSX15-G9		
Configuration	Cast iron with replaceable wet cylinder liners, in-line 6 cylinder		
Aspiration	Nonroad 2, turbocharged with air-to-air charge air cooling		
Gross engine power output, kWm (bhp)	563.0 (755.0)	507.3 (680.0)	
BMEP at set rated load, kPa (psi)	2433.9 (353.0)	2213.2 (321.0)	
Bore, mm (in)	136.9 (5.39)		
Stroke, mm (in)	168.9 (6.65)		
Rated speed, rpm	1800		
Piston speed, m/s (ft/min)	10.1 (1995.0)		
Compression ratio	17.0:1		
Lube oil capacity, L (qt)	83.3 (88.0)		
Overspeed limit, rpm	2150 ± 50		
Regenerative power, kW	52.00		

Fuel flow

Fuel flow at rated load, L/hr (US gph)	423.9 (112.0)	
Maximum inlet restriction, mm Hg (in Hg)	127.0 (5.0)	
Maximum return restriction, mm Hg (in Hg)	165.1 (6.5)	

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Air

	Standby rating	Prime rating	Continuous rating
Combustion air, m^3/min (scfm)	41.6 (1470.0)	38.8 (1370.0)	
Maximum air cleaner restriction, kPa (in H_2O)	6.2 (25.0)		
Alternator cooling air, m^3/min (scfm)	62.0 (2190.0)		

Exhaust

Exhaust flow at set rated load, m^3/min (cfm)	102.6 (3625.0)	88.7 (3135.0)	
Exhaust temperature, °C (°F)	482.8 (901.0)	466.7 (872.0)	
Maximum back pressure, kPa (in H_2O)	10.2 (41.0)		

Standard set-mounted radiator cooling

Ambient design, °C (°F)	40 (104)		
Fan load, kW_m (HP)			
Coolant capacity (with radiator), L (US gal)	57.9 (15.3)		
Cooling system air flow, m^3/min (scfm)	707.5 (25000.0)		
Total heat rejection, MJ/min (Btu/min)	22.9 (21635.0)	19.8 (18700.0)	
Maximum cooling air flow static restriction, kPa (in H_2O)	0.12 (0.5)		

Optional set-mounted radiator cooling

Ambient design, °C (°F)			
Fan load, kW_m (HP)			
Coolant capacity (with radiator), L (US gal)			
Cooling system air flow, m^3/min (scfm)			
Total heat rejection, MJ/min (Btu/min)			
Maximum cooling air flow static restriction, kPa (in H_2O)			

Optional heat exchanger cooling

Set coolant capacity, L (US gal)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum raw water pressure, jacket water circuit, kPa (psi)			
Maximum raw water pressure, aftercooler circuit, kPa (psi)			
Maximum raw water pressure, fuel circuit, kPa (psi)			
Maximum raw water flow, jacket water circuit, L/min (US gal/min)			
Maximum raw water flow, aftercooler circuit, L/min (US gal/min)			
Maximum raw water flow, fuel circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, jacket water circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, aftercooler circuit, L/min (US gal/min)			
Minimum raw water flow at 27 °C (80 °F) inlet temp, fuel circuit, L/min (US gal/min)			
Raw water delta P at min flow, jacket water circuit, kPa (psi)			
Raw water delta P at min flow, aftercooler circuit, kPa (psi)			
Raw water delta P at min flow, fuel circuit, kPa (psi)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			

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Optional remote radiator cooling[1]	Standby rating	Prime rating	Continuous rating
Set coolant capacity, L (US gal)			
Max flow rate at max friction head, jacket water circuit, L/min (US gal/min)			
Max flow rate at max friction head, aftercooler circuit, L/min (US gal/min)			
Heat rejected, jacket water circuit, MJ/min (Btu/min)			
Heat rejected, aftercooler circuit, MJ/min (Btu/min)			
Heat rejected, fuel circuit, MJ/min (Btu/min)			
Total heat radiated to room, MJ/min (Btu/min)			
Maximum friction head, jacket water circuit, kPa (psi)			
Maximum friction head, aftercooler circuit, kPa (psi)			
Maximum static head, jacket water circuit, m (ft)			
Maximum static head, aftercooler circuit, m (ft)			
Maximum jacket water outlet temp, °C (°F)			
Maximum aftercooler inlet temp at 25 °C (77 °F) ambient, °C (°F)			
Maximum aftercooler inlet temp, °C (°F)			
Maximum fuel flow, L/hr (US gph)			
Maximum fuel return line restriction, kPa (in Hg)			

Weights[2]

Unit dry weight kgs (lbs)	4309 (9500)
Unit wet weight kgs (lbs)	4445 (9800)

Notes:

[1] For non-standard remote installations contact your local Cummins Power Generation representative.

[2] Weights represent a set with standard features. See outline drawing for weights of other configurations.

Derating factors

Standby	Genset may be operated up to 640 m (2100 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 1150 m (3770 ft), derate by 3.8% per 305 m (1000 ft), and 6.1% per 10 °C (3.4% per 10 °F). Above 1150 m (3770 ft) up to 1680 m (5510 ft), derate 6.3% total for 1150 m (3770 ft) plus 1.6% per 305 m (1000 ft) over 1150 m (3770 ft) and 3.8% per 10 °C (2.2% per 10 °F). Above 1680 m (5510 ft), up to 3000 m (9840 ft), derate 9.0% total for 1680 m (5510 ft) plus 3.7% per 305 m (1000 ft) and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 24.8% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) above 3000 m (9840 ft) and 10% per 10 °C (5.6% per 10 °F).
Prime	Genset may be operated up to 640 m (2100 ft) and 40 °C (104 °F) without power deration. For sustained operation above these conditions up to 1150 m (3770 ft), derate by 3.8% per 305 m (1000 ft), and 6.1% per 10 °C (3.4% per 10 °F). Above 1150 m (3770 ft) up to 1680 m (5510 ft), derate 6.3% total for 1150 m (3770 ft) plus 1.6% per 305 m (1000 ft) over 1150 m (3770 ft) and 3.8% per 10 °C (2.2% per 10 °F). Above 1680 m (5510 ft), up to 3000 m (9840 ft), derate 9.0% total for 1680 m (5510 ft) plus 3.7% per 305 m (1000 ft) and 5.7% per 10 °C (3.2% per 10 °F). Above 3000 m (9840 ft), derate 24.8% total for 3000 m (9840 ft) plus 1.8% per 305 m (1000 ft) above 3000 m (9840 ft) and 10% per 10 °C (5.6% per 10 °F).
Continuous	

Ratings definitions

Emergency standby power (ESP):	**Limited-time running power (LTP)**:	**Prime power (PRP)**:	**Base load (continuous) power (COP)**:
Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.	Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.	Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) is in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.

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Power Generation

Alternator data

Three phase table[1]		105 °C	105 °C	105 °C	125 °C	125 °C	125 °C	125 °C	125 °C	150 °C	150 °C	150 °C	150 °C
Feature code		B262	B301	B252	B258	B252	B414	B246	B300	B426	B413	B424	B419
Alternator data sheet number		308	307	307	308	307	308	306	306	307	307	305	306
Voltage ranges		110/190 thru 139/240 220/380 thru 277/480	347/600	120/208 Thru 139/240 240/416 Thru 277/480	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600	110/190 thru 139/240 220/380 thru 277/480	120/208 thru 139/240 240/416 thru 277/480	277/480	347/600
Surge kW		514	517	514	514	514	516	515	515	512	514	512	515
Motor starting kVA (at 90% sustained voltage)	Shunt												
	PMG	2429	2208	2208	2429	2208	2429	1896	1896	2208	2208	1749	1896

Full load current amps at standby rating	110/190	120/208	110/220	115/230	139/240	220/380	230/400	240/416	255/440	277/480	347/600
	1901	1737	1642	1571	1505	951	903	868	821	753	602

[1] Single phase power can be taken from a three phase generator set at up to 40% of the generator set nameplate kW rating at unity power factor.

Formulas for calculating full load currents:

Three phase output

$$\frac{\text{kW} \times 1000}{\text{Voltage} \times 1.73 \times 0.8}$$

Single phase output

$$\frac{\text{kW} \times \text{SinglePhaseFactor} \times 1000}{\text{Voltage}}$$

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Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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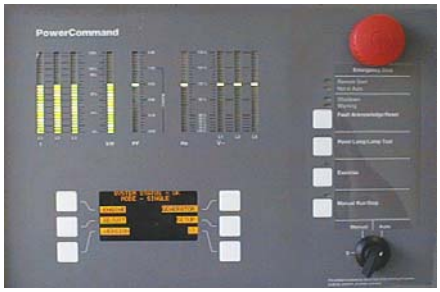
Power Generation

PowerCommand® 3201 digital generator set control



> Specification sheet

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Cummins® Power Generation

Description

The PowerCommand® 3201 Control is a microprocessor-based generator set monitoring, metering and control system. The control provides an operator interface to the genset, digital voltage regulation, digital governing and generator set protective functions. It may incorporate optional automatic digital paralleling controls and/or power transfer controls. The integration of all the functions into a single control system provides enhanced reliability and performance compared to conventional control systems.

The PowerCommand control is designed for mounting on the generator set and is suitable for use on generator sets ranging in size from 20 kW to 4000 kW. It will directly read AC voltages up to 600 VAC and can be configured for any frequency, voltage and power connection configuration from 120 to 13,800 VAC. The operator panel may be remote-mounted from the generator set and connected via an RS485 network connection.

The control offers a wide range of standard control and digital display features so custom control configurations are not needed to meet application requirements and system reliability is not compromised by use of untested special components.

Power for PowerCommand Control is usually derived from the generator set starting batteries. It functions over a voltage range from 8 VDC to 35 VDC.

Features

Digital full authority electronic engine controls - Provide engine monitoring, protection and governing. These functions are integrated with voltage regulation and paralleling functions for optimum system performance.

Digital voltage regulation - Provides fast, controlled response to load changes and high levels of immunity to the effects of non-linear loads.

AmpSentry™ protective relay - UL Listed, true alternator overcurrent protection.

AC output metering - Includes analog and digital display.

Battery monitoring system - Senses and warns against weak battery condition that is not detected by conventional DC over and undervoltage monitoring.

Message display - Digital alarm and status.

Generator set monitoring - Displays status of all critical engine and alternator generator set functions.

Smart starting control system - Integrated fuel ramping to limit black smoke and frequency overshoot, in addition to optimized cold weather starting.

Advanced serviceability - Utilizes InPower™, a PC-based software service tool.

Digital power transfer control - Optional control functions that allow operation in open transition, closed transition or soft (ramping) transfer modes.

PowerCommand LonWorks® network - Optional network interface providing expanded input/output capability, remote monitoring and control by annunciators and other equipment, and easier installation.

Warranty - Backed by a comprehensive warranty and worldwide distributor service network.

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Operator panel

The operator panel provides the user with a complete package of easy to view and use information. It includes an enhanced graphical operator panel that allows the user to view up to 9 lines of information, as well as graphical displays of system data. Connections to the operator panel are sealed, locking plug interfaces for reliable, vibration-resistant interconnection to the generator set wiring harness.

Control switches and functions

Off/manual/auto mode control switch - The *not in auto* lamp will flash when the control is in the *manual* or *off* mode. In the *auto* mode, the generator set can be started using the exercise push-button or with a start signal from a remote device, such as automatic transfer switches.

Manual run/stop control switch and indicating LED - When the mode control switch is in the *manual* position and the *manual run/stop* switch is pressed, the generator set will start, bypassing all time delay starts. (Time delay idle can also be bypassed with another control action.) If the generator set is running in the *manual* mode, pressing the *run/stop* switch will cause the generator set to shut down. An LED (light emitting diode) lamp adjacent to the switch will light to indicate the generator set is in manual mode.

Exercise control switch and indicating LED - When the mode control switch is in the *auto* position the *exercise* control switch is used to complete a pre-programmed exercise sequence. All exercise functions are disabled when an emergency start command is received by the control. An LED lamp adjacent to the switch will light to indicate the generator set is in exercise mode.

Panel lamp/lamp test control switch.

Fault acknowledge/reset switch - The control includes a fault acknowledge function to allow the operator to reset the fault condition. If the fault condition is not corrected, the fault will reappear, but will not be logged as a separate event. Multiple faults can be logged and displayed at one time.

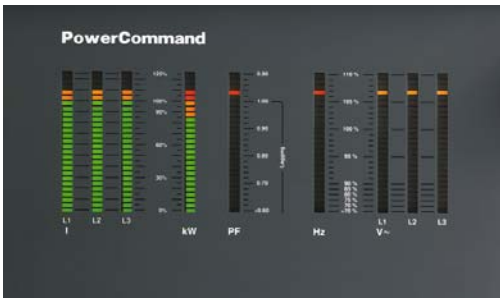
Emergency stop control switch.

Operator adjustments - The control includes provisions for many set up and adjustment functions via raise/lower switches on the operator panel. Functions that can be adjusted by the operator include:

- Time delay start (0-300 seconds)
- Time delay stop (0-600 seconds)
- Alternator voltage (±5%)
- Alternator frequency (±3 Hz)

The operator panel can be configured to require an access code prior to adjusting these values. A second access code is used to protect the control from unauthorized service level adjustments. Voltage and frequency adjustments are disabled during operation in parallel with a system bus to prevent inadvertent misadjustment of the paralleling load sharing functions.

Analog AC metering panel



The PowerCommand control is equipped with an analog AC metering panel that simultaneously displays 3-phase line-to-line AC volts and current, kW, power factor and frequency.

The meter panel is composed of a series of LEDs configured in bar graphs for each function. The LEDs are color coded with green indicating normal range values, amber for warning levels and red for shutdown conditions. Scales for each function are in % of nominal rated values.

Graphical display panel

The PowerCommand control is provided with a graphical display capable of displaying up to 9 lines of data with approximately 27 characters per line. The graphical display is accompanied by a set of six tactile-feel membrane switches that are used by the operator to navigate through control menus and to make control adjustments. Display is configurable for multiple languages. It is configurable for units of measurement. The display incorporates three levels of operation and adjustability. All data on the control can be viewed by

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scrolling through screens with the navigation keys. The top three lines of the display are allocated to mode and status messages that continuously display the operating mode of the control system, as well as any faults or warning conditions that may be present on the controller. If more than one fault or warning message is present, the messages will scroll to allow the operator to view all active messages in the system.

Screen-saver mode - The operator panel can be programmed to automatically switch off to reduce battery voltage drain when the control is not being used and the generator set is not running. Depressing any button on the operator panel, new fault conditions or receipt of a remote signal at the control will "wake up" the control.

Generator set data

Generator set hardware data - Generator set rating in kVA, complete generator set model number and serial number, engine model and serial number and alternator model and serial number. The control also displays the part number of the control and the software version present in the control.

Data logs - Number of start attempts and number of start attempts since reset. Number of times generator set has run and number of times since reset. Duration of generator set running time and duration of running time since last reset. Generator set kWh produced and kWh produced since last reset.

Adjustment history - Record of adjustment and setting changes made on the control, identifies whether adjustment was made via the operator panel or with a service tool. If a service tool is used, the control provides a record of the serial number of the tool used. This information is read with InPower.

Fault history - Record of the most recent fault conditions with time stamp, along with the number of times each fault has occurred. At least 20 events are stored in the control memory.

Load profile data - Data indicating the total operating hours at percent of load in 10% increments and since reset.

Generator set AC data

Generator set output frequency, voltage and current - All phases (line-to-line and line-to-neutral for voltage. Accuracy 1%.

Generator set power output - PowerCommand displays generator set kW and kVA output (average phase, individual phase and direction of flow) and power factor with leading/lagging indication. Accuracy 5%.

Generator set kWh energy output - Total kWh produced and total produced since last reset with time stamp of time of last reset.

Digital synchroscope - Bus voltage and frequency, generator set bus voltage and frequency, the phase angle displacement and a signal indicating "ready to close". A breaker control switch is included on this panel for convenient operation of the equipment without switching between viewing screens.

Engine data

Basic engine data - Engine starting battery voltage, engine lube oil pressure and engine coolant temperature.

Engine service data - Varies with engine used, but typically includes: Engine coolant pressure, engine fuel rail temperature and pressure, engine fuel input and output temperature, intake manifold temperature and pressure, ambient air pressure, crankcase blowby flow and aftercooler inlet coolant temperature.

Engine fuel consumption - The fuel consumed by the engine is calculated by the control based on fuel flow into the engine and returned by the engine, and the temperature of the two flow streams. Accuracy is $\pm$ 5% over 500 hours of operation. Data provided includes overall average fuel consumed and consumption since reset. This information is read with InPower.

Engine exhaust temperature (optional).

Power transfer control data (optional)

Utility (mains) source data - Displays line-to-line and line-to-neutral voltage of utility (mains) source, frequency and estimated amps, and kW and kVA supplied by utility (mains) source (optional when power transfer control is used).

System status information - Provides graphical system status display showing availability of sources and positions of each contactor.

System control - Allows operator to view status of system and manually control operation of the system. Provides manual adjustment capability for time delay start, stop, transfer and retransfer, as well as time delays for program transition (when used) and power transfer overlap time.

Internal control functions

General functions

System control voltage - The control operates on 24 VDC from the generator set starting batteries. Control functions are fully operational over a voltage range of 8 VDC to 36 VDC.

Emergency start mode - PowerCommand accepts a ground signal from remote devices or a network signal to automatically start the generator set and immediately accelerate to rated speed and voltage.

PowerCommand includes a smart starting system that is designed to quickly start the engine, minimize black smoke, minimize voltage and frequency overshoot, and

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oscillations on starting. The control system does this by careful simultaneous control of the engine fuel system and alternator excitation system.

Non-emergency start mode - The control is provided with a separate remote start input or a network signal to start the generator set via the programmable idle control. Using the non-emergency mode, the generator set takes longer to start, but there is less wear on the engine. In this start mode, the generator set will start, operate at idle speed for a predefined time period or until the engine reaches operating temperature (whichever time is shorter), and then ramp to rated speed and voltage. Time delay is adjustable from 0-300 seconds and default is 10 seconds. The control also monitors and records the source of start signals, when that information is available. The control automatically exits idle mode if an emergency remote start signal is received at the control.

Data logging - The control maintains a record of manual control operations, warning and shutdown conditions and other events. It uses the control *"on"* time as the time-stamp means when a real time clock is not included with the control. The control also stores critical engine and alternator data before and after a fault occurs, for use by InPower and the technician in evaluating the root causes for the fault condition.

Fault simulation mode - PowerCommand, in conjunction with InPower software, will accept commands to allow a technician to verify the proper operation of critical protective functions of the control by simulating failure modes or by forcing the control to operate outside of its normal operating ranges. InPower also provides a complete list of faults and settings for the protective functions of the specific generator set it is communicating with.

Built in test - The control system automatically tests itself, and all the sensors, actuators and harnesses in the control system, on a startup signal. The test can also be initiated from InPower and can be accomplished either locally to the generator set or remotely.

Engine control

Engine starting - The control operates a factory-supplied fuel valve that enables engine starting.

Cycle cranking - Configurable for number of starting cycles (1 to 7) and duration of crank and rest periods. Control includes starter protection algorithms to prevent the operator from specifying a starting sequence that might be damaging. Default setting is for (3) start cycles composed of 15 seconds of cranking and 15 seconds of rest.

Programmable idle speed control - In this mode the generator set would start and run to idle speed. It would operate at that speed for a programmed time period, then ramp to rated speed. When the control gets a signal to stop, it will ramp to idle, operate for the programmed period at idle and then shut down. During idle mode, engine protective functions are adjusted for the lower engine speed and alternator function is disabled.

Time delay start and stop (cool down) - Configurable for time delay of 0-300 seconds prior to starting after receiving a remote start signal in normal operation modes and for time delay of 0-600 seconds prior to ramp-to-idle or shutdown after signal to stop in normal operation modes. The generator set control will monitor the load during operation of the generator set, and if the total load on the set is less than 10% of rated it will reduce the operation time for the time delay stop in order to prevent extended operation of the engine at very light load levels. Default for both time delay periods is 0 seconds.

Engine governing

Isochronous governing - Controls engine speed within ± 0.25% for any steady state load from no load to full load. Frequency drift will not exceed ± 0.5% for a 33 °C (60 °F) change in ambient temperature over an 8 hour period.

Droop governing - Control can be adjusted to droop from 0 to 10% from no load to full load, using InPower.

Temperature dynamics - Modifies the engine fuel system control parameters as a function of engine temperature. Allows engine to be more responsive when warm and more stable when operating at lower temperature levels.

Isochronous load sharing control - See *Paralleling Functions/Load sharing controls*.

Droop load sharing control - See *Paralleling Functions/Load sharing controls*.

Idle mode - Engine governing can be regulated at an idle speed for a programmed period on start or stop of the engine. When the engine is operating at idle speed, the alternator excitation is automatically switched off.

Alternator control

Digital output voltage regulation - PowerCommand will regulate output voltage to within 0.5% for any loads between no load and full load. Voltage drift will not exceed ± 0.5% for a 33 °C (60 °F) change in temperature in an 8 hour period. On engine starting, or sudden load acceptance, voltage is controlled to a maximum of 5% overshoot over nominal level.

Torque-matched V/Hz overload control - The voltage roll-off set point and rate of decay (i.e., the slope of the V/Hz curve) is adjustable in the control. This function is automatically disabled when the control is in a synchronizing mode.

Fault current regulation - PowerCommand will regulate the output current on any phase to a maximum of 3 times rated current under fault conditions for both single phase and three phase faults. In conjunction with a permanent magnet generator, it will provide 3 times rated current on all phases for motor starting and short circuit coordination purposes.

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Isochronous (kVar) load sharing control - See *Paralleling Functions/Load sharing controls*.

Droop (kVar) load sharing control - See *Paralleling Functions/Load sharing controls*.

Protective functions

On a warning condition, the control will indicate a fault by lighting the warning LED on the control panel and displaying the fault name and code on the operator display panel. The nature of the fault and time of occurrence are logged in the control. The service manual and InPower service tool provide service keys and procedures based on the service codes provided.

On a shutdown condition, the control will light the shutdown LED on the control panel, display the fault name and code, initiate shutdown and lock out the generator set. The shutdown sequence of the generator set includes programmable cooldown at idle for fault conditions that do not endanger the engine. The control maintains a data log of all fault conditions as they occur and time stamps them with the controller run time and engine operating hours data. Adjustments to most set points are made using the InPower service tool.

The control system includes a *"fault bypass"* mode that forces the system to function regardless of the status of protective functions. In this mode, the only protective functions that are operational are over speed, loss of both speed sensors, moving the control switch to the *off* position or pressing the *emergency stop* switch. The control maintains a record of the time that the mode is enabled and of all warning or shutdown conditions that have occurred while in the "*fault bypass*" mode.

Many protective functions within the control system are configurable for warning, shutdown or both (2 levels). Exceptions to this include functions such as over speed conditions, and loss of speed sensing. In addition, some warning functions can incorporate control functions as a consequence of a fault.

System protective functions:

Ground fault warning (option - 600 VAC class generator sets) - Ground (earth) fault sensing is adjustable over a range of 100-1200 amps with time delays of 0-1 second. May be configured for shutdown rather than alarm.

Configurable alarm and status inputs - PowerCommand will accept up to four alarm or status inputs (contact closed to ground) to indicate customer-specified conditions. The control is programmable for warning, shutdown or status indication and for labeling the input (up to 24 characters). Sixteen additional faults can be input to the control via the network.

Breaker fail to close and breaker auxiliary contact warning or shutdown - When the paralleling control signals a circuit breaker to close, it will monitor the breaker auxiliary contacts and verify that the breaker has connected the generator set to the system bus. If the control does not sense a breaker closure within 0.5 second of the close signal, the control will monitor the phase relationship between the generator set and the bus. If this indicates that the generator set is not closed to the bus, the *"breaker fail to close"* alarm will be indicated, the breaker will be opened and the generator set shut down. If the phase relationship monitor indicates that the generator set is in parallel with the bus, "circuit breaker auxiliary contact failure" will be indicated and the generator set will continue to run in normal operation mode.

Breaker fail to open warning - The control system monitors the operation of breakers that have been signaled to open. If the breaker does not open within 1 second of initiation of signal, a *"breaker fail to open"* warning is initiated. The control will logically allow the generator set to continue to run if shutdown of the generator set with the breaker closed will cause potential damage or operating problems.

Bus or generator set PT input calibration error - The control system monitors the sensed voltage from the bus and generator set output voltage-potential transformers. When the paralleling breaker is closed, it will indicate a warning condition when they read different values.

Emergency stop - Annunciated whenever the local or remote emergency stop signal is received. Alarm panel distinguishes between local or remote operation.

AmpSentry protective relay

AmpSentry protective relay is a UL Listed comprehensive monitoring and control system integral to the PowerCommand Control System that guards the electrical integrity of the alternator and power system by providing protection against a wide array of fault conditions in the generator set or in the load. It also provides single and three phase fault current regulation so that downstream protective devices have the maximum current available to quickly clear fault conditions without subjecting the alternator to potentially catastrophic failure conditions. See document R1053 below for a full size time over current curve. The control does not include protection required for interconnection to a utility (mains) service.

Over current warning - Output current on any phase at more than 110% of rating for more than 60 seconds.

Over current shutdown (51V) - Output current on any phase is more than 110%, less than 175% of rating and approaching thermal damage point of alternator. Control includes algorithms to protect alternator from repeated over current conditions over a short period of time. The control does not include instantaneous trip functions, as they are not necessary for alternator protection and complicate short circuit coordination (discrimination).

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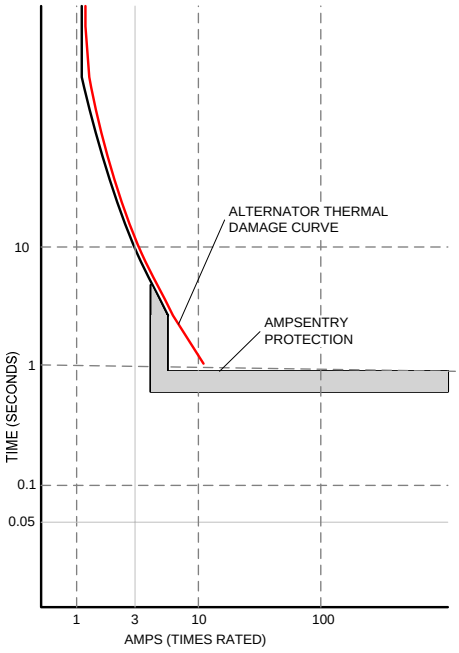

Short circuit shutdown (51) -Output current on any phase is more than 175% of rating at time of shutdown. The control replicates the function of a 51V relay by discriminating between short circuit conditions and shutdown conditions, and shutting down the genset as fast as is necessary on a short circuit condition while operating as long as is possible on an overload condition. Control includes algorithms to protect alternator from repeated over current conditions over a short time.

High AC voltage shutdown (59) - Output voltage on any phase exceeds preset values. Time to trip is inversely proportional to amount above threshold. Values adjustable from 105-125% of nominal voltage, with time delay adjustable from 0.25-10 seconds. Default value is 110% for 10 seconds.

Low AC voltage shutdown (27) - Voltage on any phase has dropped below a preset value. Adjustable over a range of 50-95% of reference voltage, time delay 2-10 seconds. Default value is 85% for 10 seconds. Function tracks reference voltage. Control does not nuisance trip when voltage varies due to the control directing voltage to drop, such as during a voltage roll-off during synchronizing.

Under frequency shutdown (81u) - Generator set output frequency cannot be maintained. Settings are adjustable from 0-10 Hz below nominal governor set point, for a 0-20 second time delay. Default: 6 Hz, 10 seconds. Under frequency protection is disabled when excitation is switched off (such as when engine is operating in idle speed mode or the synchronizer is enabled).

Over frequency shutdown/warning (81o) - Generator set is operating at a potentially damaging frequency level. Defaults: Disabled.

Over load (kW) warning - Provides a warning indication when engine is operating at a load level over a set point. Adjustment range: 80-140% of rated kW, 0-120 second delay. Defaults: 105%, 60 seconds.

Reverse power shutdown (32) - Adjustment range: 5-20% of standby kW rating, delay 1-15 seconds. Defaults: 10%, 3 seconds.

Sync check (25) - Verifies that the generator set is operating in synchronism with the system bus prior to allowing the paralleling breaker to close. Includes dead bus sensing capability.

Fail to synchronize warning or shutdown - Indicates that the generator set could not be brought to synchronization with the system bus. Configurable for warning or shutdown and adjustable for time delay of 10-120 seconds. Default is 120 seconds.

Phase sequence sensing shutdown - Verifies that the generator set phase sequence matches the bus prior to allowing the paralleling breaker to close. The generator set will shutdown if the generator set and bus phase sequence do not match.

Reverse Var shutdown - Shutdown level is adjustable: 15-50% of rated Var output, delay 10-60 seconds. Defaults: 20%, 10 seconds.

High alternator temperature (option).

Engine protection

Over speed shutdown - Default setting is 115% of nominal.

Low lube oil pressure shutdown - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

Low lube oil pressure warning - Level is preset to match the capabilities of each engine. Control includes time delays to prevent nuisance shutdown signals.

High coolant temperature shutdown.

High coolant temperature warning.

Low coolant pressure warning/shutdown.

Low coolant level warning/shutdown.

Low coolant temperature warning - Indicates that engine temperature may not be high enough for a 10 second start or proper load pickup.

Low and high battery voltage warning - Indicates battery charging system failure by continuously monitoring battery voltage and indicating a problem when voltage is outside a preset acceptance band.

Discharged battery protection - When DC voltage is below a preset threshold, the control will shut down to avoid completely discharging the battery.

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Weak battery warning - The control system will test the battery bank each time the generator set is signaled to start and indicate a warning if the generator set battery indicates impending failure.

Fail to start (overcrank) shutdown.

Fail to crank shutdown - Control has signaled starter to crank engine but engine does not rotate.

Redundant starter disconnect.

Redundant speed sensors - Loss of one sensor results in a mag pickup sensor warning. Loss of both sensors results in mag pickup failure.

Low fuel day tank and low fuel main tank warning.

Cranking lockout - The control will not allow the starter to attempt to engage or to crank the engine when the engine is rotating.

Sensor failure indication - All analog sensors are provided with sensor failure logic to indicate if the sensor or interconnecting wiring has failed. Separate indication is provided for fail high or low.

High crankcase blowby level warning.

High fuel temperature warning.

High intake manifold temperature/pressure.

Aftercooler cooler inlet over temperature.

Paralleling functions (optional)

First Start Sensor™ System - PowerCommand provides a unique control function that positively prevents multiple generator sets from simultaneously closing to an isolated bus under black start conditions. The First Start Sensor system is a communication system between generator sets that allows the generator sets to work together to determine which generator set in a system should be the first to close to the bus. The system includes an independent backup function, so that if the primary system is disabled the required functions are still performed.

Synchronizer - PowerCommand incorporates a digital synchronizing function to force the generator set to match the phase relationship and voltage of the generator set output with the system bus or utility grid. The synchronizer includes provisions to provide proper operation even with highly distorted bus voltage waveforms. The synchronizer includes adjustments for phase angle window (5°-20°) and time delay (0.5-5 seconds). The synchronizer is 3-phase sensing, and includes controls to directly operate a paralleling breaker. The breaker controls include fail to open and fail to close protection.

Load sharing controls - The generator set control includes an integrated load sharing control system for both real (kW) and reactive (kVar) loads when the generator set(s) are operating on an isolated bus. The control system determines kW load on the engine and kVar load on the alternator as a percent of generator set capacity, and then regulates fuel and excitation systems to maintain system and genset at the same percent of load without impacting voltage or frequency regulation. The control can also be configured for operation in droop mode for kW or Kvar load sharing.

Load govern controls - When PowerCommand receives a signal indicating that the generator set is paralleled with an infinite source such as a utility (mains) service, the generator set will operate in load govern mode. In this mode the generator set will synchronize and close to the bus, ramp to a pre-programmed kW and kVar load level, and then operate at that point. Control is adjustable for kW values from 0-100% of standby rating, and 0.7-1.0 power factor (leading). Default setting is 80% of standby and 1.0 power factor. The control includes inputs to allow independent control of kW and kVar load sharing level by a remote device while in the load govern mode. The rate of load increase and decrease is also adjustable in the control.

Load demand control - The control system includes the ability to respond to an external signal to initiate load demand operation. On command, the generator set will ramp to no load, open its paralleling breaker, cool down, and shut down. On removal of the command, the generator set will immediately start, synchronize, connect, and ramp to its share of the total load on the system.

Power transfer control (optional)

The Power transfer control feature allows PowerCommand to provide integrated automatic power transfer functions including source availability sensing and transfer device (circuit breaker) monitoring and control. The control is configurable for open transition, fast transfer (100 mS), or soft (ramping) sequences of operation. Standard functions include:

- 3-phase (line-to-neutral) close differential under voltage sensing for utility (mains) service. Sensing for pickup in an adjustable range from 85-100% of nominal, with default at 95% of dropout setting. Dropout is configurable 75-98% of pickup, with default at 85%.
- 3-phase over voltage sensing for normal utility service adjustable for pickup at 95-105% of dropout and dropout configurable for 105-135% of nominal. Time delay is adjustable in a range of 0.5-120 seconds. Default is disabled and is enabled using InPower.
- Under frequency sensing for normal utility service. Adjustment range is 80-95% of nominal. Default is disabled and is enabled using InPower.
- Configurable sequence of operation with or without adjustable program-transition capability. Adjustment range is 0-60 seconds.
- Remote exercise feature accepts a remote signal to initiate with or without load testing, or testing can be

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initiated by the operator. Test sequence may include a programmed idle period prior to acceleration to rated voltage and frequency, and after cool down. Test may be configured to be performed with load or without load.

- Time delay start and stop as described in this document; time delay transfer adjustable in a range of 0-120 seconds and retransfer in a range of 0-1800 seconds; all in 1-second increments.
- Fail to disconnect timer is adjustable in a range of 0.1 to 120 seconds.

Environment

The control is designed for proper operation without recalibration in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

The operator control panel has a single membrane surface which is impervious to the effects of dust, moisture, oil and exhaust fumes. The panel uses sealed membrane or oil-tight switches to provide long reliable service life in harsh environments.

The control system is specifically designed for resistance to RFI/EMI and to resist the effects of vibration to provide a long reliable life when mounted on a generator set. The control includes transient voltage surge suppression to provide compliance to referenced standards.

The control is mounted on a vibration-isolated structure attached to the generator set skid and includes all generator set wiring factory-installed.

Control interface

Input signals to the PowerCommand control include:

Remote start signal - May be connected via either discrete signal or Lon® Network or both for premium reliability. Discrete signal is normally open contact to ground or normally closed contact that opens to indicate start signal. Separate signal inputs available for emergency start and non-emergency start.

Remote emergency stop.

Low main or day tank fuel level warning.

Remote alarm reset.

Load demand stop.

Utility parallel (load govern) mode command.

Configurable customer inputs - Control includes provisions for (4) input signals from customer discrete devices. (16) additional input signals can be implemented with the use of external network modules.

Output signals from the control include:

Generator set running signal - Fused normally open contact rated 5 A at 30 VDC/180 VAC, closes to indicate generator set is running.

Generator set common shutdown signal - Self-protected relay driver.

Load shed signal - Self-protected relay driver. Operation is configurable for under frequency or over kW load or both. Adjustment range is 80-140% of standby rating with time delay of 0-120 seconds. Default settings are overload 105%, 60 sec, and under frequency 3 Hz below governor reference for 3 seconds.

Ready to load signal - Self-protected relay driver. Operates when the generator set has reached 90% of rated speed and voltage and latches until generator set is switched to off or idle mode.

Modem control signal - Self-protected relay driver.

Paralleling breaker interface - Fused normally open relay contact (5 A, 30 VDC/180 VAC) for parallel breaker close signal and normally open contact for parallel breaker open signal.

Control power for auxiliary devices is available from the controller.

Network connections include:

Serial interface - This communication port is to allow the control to communicate with a personal computer running InPower service and maintenance software.

Echelon® LonWorks interface (option) – System allows for fast, effective incorporation of auxiliary I/O, remote annunciation, redundant start commands from Cummins transfer switches, and other control functions.

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Software

InPower - An optional PC-based software service tool that is designed to directly communicate to PowerCommand generator sets and transfer switches to facilitate service and monitoring of these products.

PowerCommand for Windows® - An optional software tool that is used to remotely monitor and control generator sets, transfer switches and other on-site power system devices.

Certifications

PowerCommand meets or exceeds the requirements of the following codes and standards:

NFPA110: For Level 1 systems

UL508: Recognized or Listed and suitable for use on UL 2200 Listed generator sets

CSA C282-M: 1999 compliance

CSA 22.2 No. 14 M91: Industrial Controls

ISO 8528-4: 1993 compliance, Controls and Switchgear

NFPA99: Standard for Health Care Facilities

CE Mark

EN 50081-1: Residential, Commercial, Light Industrial

EN 50081-2: Industrial

EN 50082-1: Residential, Commercial, Light Industrial

EN 50082-2: Industrial

ISO 7637, pulses #2b, 4: DC Supply Surge Voltage Test

Mil Std 202C, Method 101: Salt Fog Test

ANSI C62.41: Surge Withstand

IEC 801.2, 3, 4, 5

ISO9001: PowerCommand control systems and generator sets are designed and manufactured in ISO9001 certified facilities.

Warranty

PowerCommand control systems are a part of complete power systems provided by Cummins Power Generation and are covered by a one year limited warranty as a standard feature.

Extended warranty options are available for coverage up to 10 years.

Options and accessories

- ❑ Isolated bus paralleling. Provides all automatic and manual paralleling functions for systems that operate isolated from the utility service.
- ❑ Full function paralleling. Provides all paralleling functions, including automatic and manual operation, protection, and other features described in this document.
- ❑ Open transition power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and a generator in a “break before make” sequence.
- ❑ Fast closed transition power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and generator in a “make before break” sequence between live sources, and “break before make” from a failed source. Overlap between sources is 100 mS or less.
- ❑ Closed transition (ramping) power transfer control. Control will operate two circuit breakers to provide power transfer between a normal source and generator in a “make before break” sequence between live sources, and “break before make” from a failed source. Overlap time between sources is configurable, and control ramps load from source to source to minimize disturbances on transfer.
- ❑ Key-type mode select switch.
- ❑ Ground fault alarm module.
- ❑ Exhaust temperature monitoring.
- ❑ Alternator temperature monitoring.
- ❑ Network Interface Module
- ❑ Digital remote annunciator. (See S-1343)
- ❑ Digital output relay module
- ❑ Modbus® interface. (See S-1471)
- ❑ Cummins Power Generation iWatch™ remote monitoring system (S-1518)
- ❑ Cummins Power Generation iWatch Wireless™ remote monitoring system (S-1572)
- ❑ ILSI (isochronous load sharing interface). Allows PowerCommand to share real load with other load sharing systems that incorporate analog load sharing lines. See document C604 for more information.
- ❑ Utility protective relaying. Gensets can be provided with power switching mechanisms and utility grade protective relaying to meet local grid protection requirements.

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Power Generation

See your distributor for more information

Cummins Power Generation

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building electrical except through an approved device or after building main breaker is open.

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Power Generation

Exhaust Emission Data Sheet
500DFEK
60 Hz Diesel Generator Set
Nonroad

Engine Information:

Model:	Cummins Inc. QSX15-G9 Nonroad 2	Bore:	5.39 in. (137 mm)
Nameplate BHP @ 1800 RPM:	755	Stroke:	6.65 in. (169 mm)
Type:	4 Cycle, In-Line, 6 Cylinder Diesel	Displacement:	912 cu. in. (14.9 liters)
Aspiration:	Turbo-charged with air-to-air charge air cooling		
Compression Ratio:	17:1		
Emission Control Device:	Turbocharged and Charge Air Cooled		

	1/4	1/2	3/4	Full	Full
PERFORMANCE DATA	**Standby**	**Standby**	**Standby**	**Standby**	**Prime**
Engine HP @ Stated Load (1800 RPM)	202	379	555	732	668
Fuel Consumption (gal/hr)	11.3	18.7	25.8	34.7	30.6
Exhaust Gas Flow (CFM)	1400	2150	2730	3625	3160
Exhaust Temperature (°F)	745	830	820	900	880
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.18	0.07	0.06	0.11	0.08
NOx (Oxides of Nitrogen as NO2)	2.85	3.60	4.60	4.85	5.15
CO (Carbon Monoxide)	0.45	0.33	0.47	0.31	0.41
PM (particular Matter)	0.08	0.05	0.05	0.05	0.02
Smoke (Pierburg)	0.52	0.55	0.61	0.31	0.38

All values are Grams per HP-Hour

TEST METHODS AND CONDITIONS

Test Methods:
Steady-State emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rated stabilized.

Fuel Specification: 40-48 Cetane Number, 0.05 Wt.% max. Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.

Reference Conditions:
25 °C (77 °F) Air Inlet Temperature, 40 °C (104 °F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H_2O/lb) of dry air Humidity (required for NOx correction); Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Tests conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Data Subject to Change Without Notice.

Power Generation

EPA Tier 2 Exhaust Emission Compliance Statement 500DFEK

60 Hz Diesel Generator Set

Compliance Information:

The engine used in this generator set complies with U.S. EPA and California emission regulations under the provisions of 40 CFR 89, Nonroad (Mobile Off Highway) Tier 2 emissions limits when tested per ISO 8178 D2.

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	CEX-NRCI-08-42
Effective Date:	12/19/2007
Date Issued:	12/19/2007
EPA Nonroad Diesel Engine Family:	8CEXL015.AAB
CARB Executive Order:	U-R-002-0450

Engine Information:

Model:	Cummins Inc. QSX15-G9 Nonroad 2	Bore:	5.39 in. (137 mm)
Engine Nameplate HP:	755		
Type:	4 Cycle, In-Line, 6 Cylinder Diesel	Stroke:	6.65 in. (169 mm)
Aspiration:	Turbo-charged with air-to-air charge air cooling	Displacement:	912 cu. in. (14.9 liters)
Compression Ratio:	17:1		
Emission Control Device:	Turbocharged with Charge Air Cooled		

U.S. Environmental Protection Agency Nonroad Tier 2 Limits

(All values are Grams per HP-Hour)

COMPONENT	
NOx + HC (Oxides of Nitrogen as NO2 + Total Unburned Hydrocarbons)	4.8
CO (Carbon Monoxide)	2.6
PM (Particulate Matter)	0.15

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Cooling System Data
DFEK

50 Degree C Ambient Radiator Cooling System

	Duty	Rating (kW)	Max Cooling @ Air Flow Static Restriction, Unhoused (inches water/mm water)					Housed in Free Air, No Air Discharge Restriction				
			0.0/0.0	0.25/6.4	0.5/12.7	0.75/19.1	1.0/25.4	F183	F184	F200	F201	F202
			Maximum Allowable Ambient Temperature, Degree C									
60Hz	Standby	500	55	55	55	55	55	N/A	N/A	54	54	53
	Prime	455	55	55	55	55	55	N/A	N/A	N/A	N/A	N/A
50Hz	Standby	440	55	55	55	55	54	N/A	N/A	N/A	N/A	N/A
	Prime	400	55	55	55	55	53	N/A	N/A	N/A	N/A	N/A

Notes:

1. Data shown are anticipated cooling performance for typical generator set.
2. Cooling data is based on 1000 ft (305 m) site test location.
3. Generator set power output may need to be reduced at high ambient conditions. Consult generator set data sheet for derate schedules.
4. Cooling performance may be reduced due to several factors including but not limited to: Incorrect installation, improper operation, fouling of the cooling system, and other site installation variables.

PROTOTYPE TEST SUPPORT (PTS)
60 HZ TEST SUMMARY

Power Generation

GENERATOR SET MODELS	REPRESENTATIVE PROTOTYPE	
350DFEG	Model:	500DFEK
400DFEH	Engine:	QSX15-G9
450DFEJ	Alternator:	HC5F
→ 500DFEK		

The following summarizes prototype testing conducted on the designated representative prototype of the specified models. This testing is conducted to verify the complete generator set electrical and mechanical design integrity. Prototype testing is conducted only on generator sets not sold as new equipment.

Maximum Surge Power: 516 **kW**

The generator set was evaluated to determine the stated maximum surge power.

Maximum Motor Starting: 2429 **kVA**

The generator set was tested to simulate motor starting by applying the specified kVA load at low lagging power factor (0.4 or lower). With this load applied, the generator set recovered to a minimum of 90% rated voltage.

Torsional Analysis and Testing:

The generator set was tested to verify that the design is not subjected to harmful torsional stresses in excess of 5000 psi. A spectrum analysis of the transducer output was conducted over the speed range of 1200 to 2000 RPM.

Cooling System: 50 ºC Ambient
0.5 in. H2O restriction

The cooling system was tested to determine ambient temperature and static restriction capabilities. The test was performed at full rated load in elevated ambient temperature under static restriction conditions.

Durability:

The generator set was subjected to a minimum 500 hour endurance test operating at varialbe load up to the standby rating based upon MIL-STD-705 to verify structural soundness and durability of the design.

Electrical and Mechanical Strength:

The generator set was tested to several single phase and three phase faults to verify that the generator can safely withstand the forces associated with short circuit conditions. The generator set was capable of producing full rated output at the conclusion of the testing.

Steady State Performance:

The generator set was tested to verify steady state operating performance was within the specified maximum limits.

Voltage Regulation:	± 0.5 %
Random Voltage Variation:	± 0.3 %
Frequency Regulation:	Isochronous
Random Frequency Variation:	± 0.25 %

Transient Performance:

The generator set was tested with the standard alternator to verify single step loading capability as required by NFPA 110 and verify acceptable voltage and frequency response on load addition or rejection. The following results were recorded:

Full Load Acceptance:	
Voltage Dip:	32.1 %
Recovery Time:	3.4 Second
Frequency Dip:	10.8 %
Recovery Time:	4 Second
Full Load Rejection:	
Voltage Rise:	16.3 %
Recovery Time:	0.9 Second
Frequency Rise:	4 %
Recovery Time:	0.6 Second

Harmonic Analysis:

(per MIL-STD-705B, Method 601.4)

	Line to Line		Line to Neutral	
Harmonic	No Load	Full LOad	No Load	Full Load
3	0.104	0.026	0.1	0.044
5	0.38	2.1	0.36	2.5
7	0.42	0.58	0.42	1.1
9	0.033	0.014	0	0.066
11	0.74	0.77	0.74	0.72
13	0.25	0.235	0.2	0.3
15	0.02	0.18	0	0.012

ALTERNATOR DATA SHEET — Frame Size HC5F

CHARACTERISTICS

WEIGHTS:	Wound Stator Assembly:	1776 lb	800 kg
	Rotor Assembly:	1512 lb	681 kg
	Complete Assembly:	3738 lb	1684 kg
MAXIMUM SPEED:		2250	rpm
EXCITATION CURRENT:	Full Load	1.72	Amps
	No Load	0.40	Amps
INSULATION SYSTEM:	Class H Throughout		

3 ∅ RATINGS (0.8 power factor) (Based on specific temperature rise at 40°C ambient temperature)		**60 Hz** (winding no)				**50 Hz** (winding no)		
		110/190 220/380 (311/312)	120/208 240/416 (311/312)	139/240 277/480 (311/312)	347/600 (07/17)	110/190 220/380 (311/312)	120/208 240/415 (311/312)	127/220 254/440 (311/312)
150°C Rise Ratings	kW	570	625	700	700	568	568	552
	kVA	713	781	875	875	710	710	690
125°C Rise Ratings	kW	538	590	660	660	536	536	520
	kVA	673	738	825	825	670	670	650
105°C Rise Ratings	kW	500	550	600	600	496	496	480
	kVA	625	688	750	750	620	620	600
80°C Rise Ratings	kW	440	484	528	528	432	432	416
	kVA	550	605	660	660	540	540	520

REACTANCES (per unit ± 10%) (Based on full load at 125C Rise Rating)	110/190 220/380	120/208 240/416	139/240 277/480	347/600	110/190 220/380	120/208 240/415	127/220 254/440
Synchronous	3.64	3.33	2.80	2.80	2.90	2.43	2.10
Transient	0.17	0.15	0.13	0.13	0.17	0.14	0.12
Subtransient	0.12	0.11	0.09	0.09	0.11	0.09	0.08
Negative Sequence	0.23	0.21	0.18	0.18	0.18	0.15	0.13
Zero Sequence	0.10	0.09	0.08	0.08	0.08	0.07	0.06

MOTOR STARTING	Broad Range	600	Broad Range
Maximum kVA (90% Sustained Voltage)	2429	2429	1769

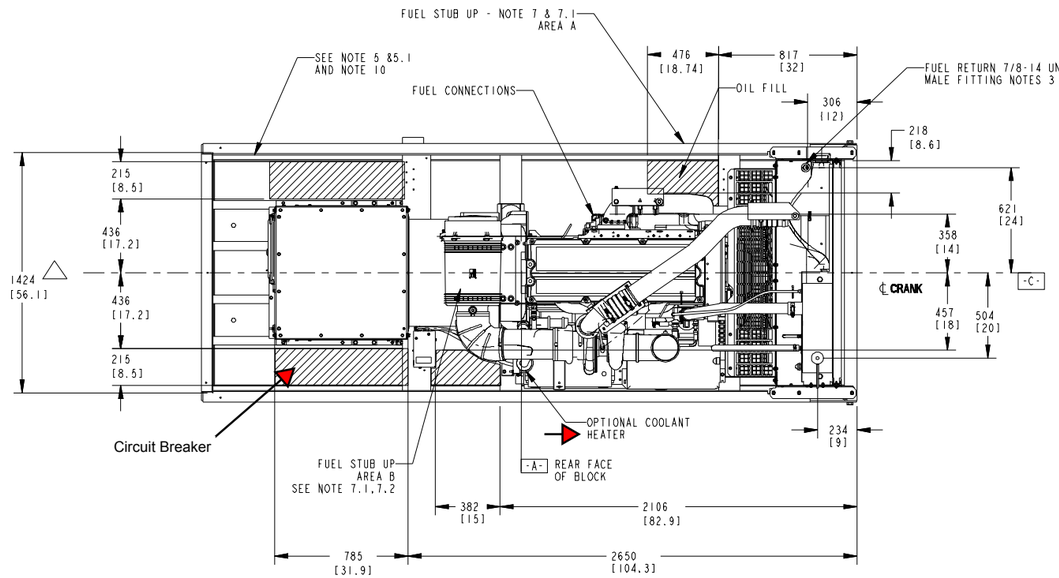
TIME CONSTANTS (Sec)	Broad Range	600	Broad Range
Transient	0.080	0.080	0.080
Subtransient	0.012	0.012	0.012
Open Circuit	2.500	2.500	2.500
DC	0.019	0.019	0.019

WINDINGS (@20°C)	Broad Range	600	Broad Range
Stator Resistance (Line to Line, Ohms)	0.0062	0.0098	0.0062
Rotor Resistance (Ohms)	2.1600	2.1600	2.1600
Number of Leads	12	6	12

Single phase power can be taken up to 40% of 3 phase- ratings

0500_4227	D	Pro/ENGINEER	METRIC DWG

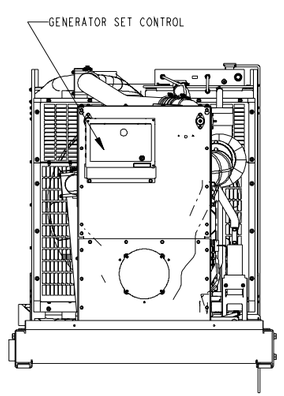
REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD23203	A	1	PRODUCTION_RELEASE	-	RAP	EW	E.WANG	04-20-05
FRD28410	B	1	MODEL FIRST USED ON WAS DEFG, EH, EJ, EK	2A	GJT	BG	HLS	06-29-06

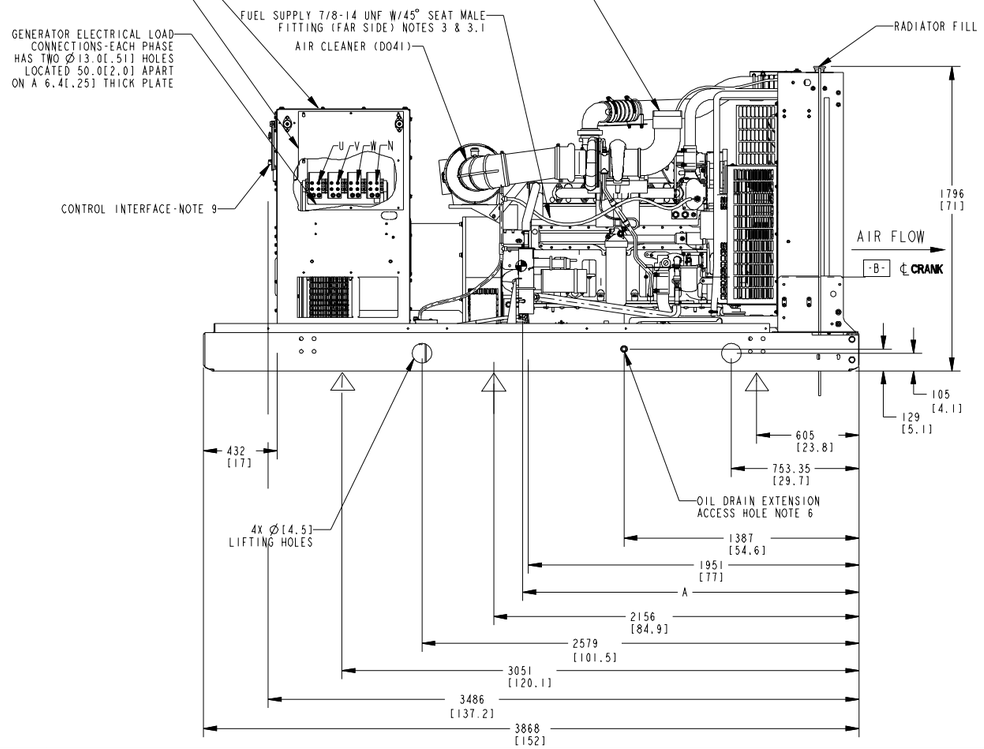


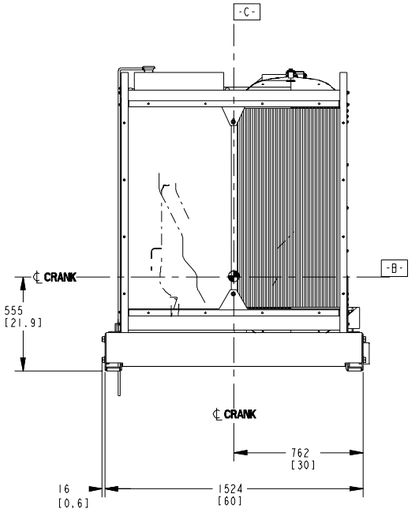
ALT DATA SHT #	DIM "A" MN	[IN]	GEN SET WET WEIGHT KG	[LB]
305	1882	[74.1]	4030	[8880]
306	1913	[75.3]	4160	[9160]
307	1895	[74.6]	4030	[8880]
308	1981	[78.0]	4440	[9780]

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN INCHES.
2. Ø17.5 [.69] HOLES MARKED BY △ ARE FOR 6 POINT ISOLATION MOUNTING OR SECURING TO MOUNTING SUFACE.
3. GENSET SUPPLIED WITH FLEXIBLE FUEL LINES THAT CAN BE CONNECTED TO GENERATOR SET INTERFACE POINTS.
- 3.1 FUEL SUPPLY LINE: 1600 [63] LONG WITH 1/2-14 NPT (MALE) TEEMINATION. FUEL RETURN LINE: 2166 [85] LONG WITH 1/2-14 NPT (MALE) TERMINATION.
4. TABULATED WEIGHT AND CG IS FOR GENERATOR SET WITH NO OPTIONS.
5. REFER TO CIRCUIT BREAKER OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA FOR SPECIFIC BREAKERS.
- 5.1 REFER TO SUBBASE FUEL TANK OUTLINE DRAWING FOR ELECTRICAL STUB-UP AREA AVAILABLE WITH FUEL TANKS.
6. OIL DRAIN ACCESS HOLE LOCATED ON FARSIDE WHEN GENSET IS NOT EQUIPPED WITH IN-SKID FUEL TANK.
7. FUEL STUB-UP AREA "A" IS NOT AVAILABLE WITH IN-SKID TANK.
- 7.1 FUEL STUB-UP AREAS SHOWN ARE NOT AVAILABLE WITH SUBBASE FUEL TANK REFER TO SUBBASE FUEL TANK OUTLINE FOR AVAILABLE STUB-UP AREAS.
- 7.2 FUEL STUB-UP AREA "B" IS AVAILABLE FOR IN-SKID TNK.
8. DIMENSION IS △2 AS INDICATED ON CIRCUIT BREAKER OUTLINE DRAWING (0500_4233).
9. CONTROL INTERFACE CONNECTIONS SHOULD BE MADE WITH FLEXIBLE CONNECTIONS. NOT RIGID CONDUIT.
10. FOR ENTRANCE BOX APPLICATIONS SEE APPLICABLE ENTRANCE BOX OUTLINE DRAWING.
11. OPTIONAL ENTRANCE BOX (NOT SHOWN) WILL BE MOUNTED ON THE RIGHT SIDE AS VIEWED FROM THE CONTROL.
12. OPTIONAL BREAKER BOX (NOT SHOWN) WILL BE MOUNTED ON THE LEFT SIDE AS VIEWED FROM THE CONTROL UNLESS OTHERWISE SPECIFIED.







STANDARD SKID BASE

(B1)

QTY	ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ±1	.X ±
	.X ±0.8	.XX ±
	.XX ±0.38	.XXX±

HOLE			
	0.00-4.99	+0.15/-0.00	.004-.200 +.006/-.003
	5.00-9.99	+0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49	+0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99	+0.30/-0.13	.704-.999 +.012/-.005

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	NAME	DATE
DR	R_PAUTZKE	04-20-05
CHKR □ MFG □	E.WANG	04-20-05
APPROVED	E.WANG	04-20-05

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON DFEG,EH,EJ,EK

SITE CODE PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE GENSET_OUTLINE .

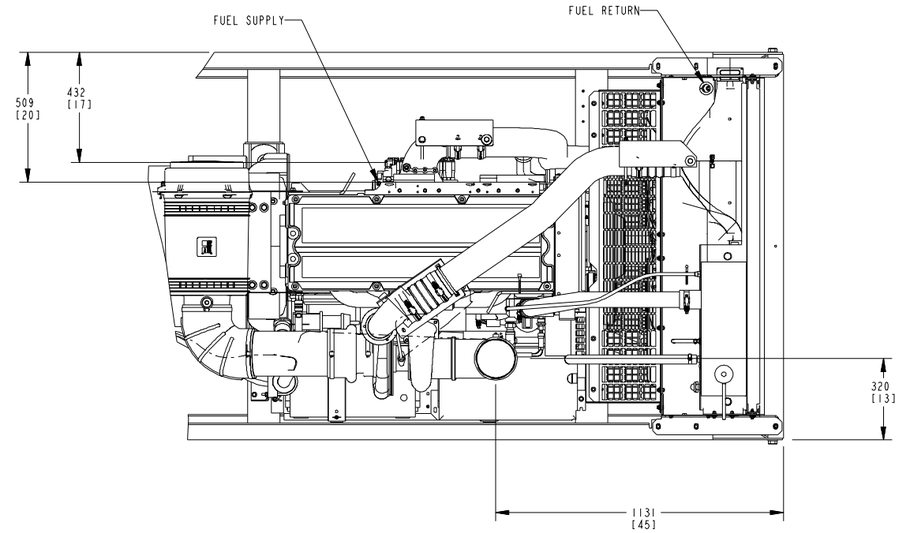
DRG NO 0500_4227

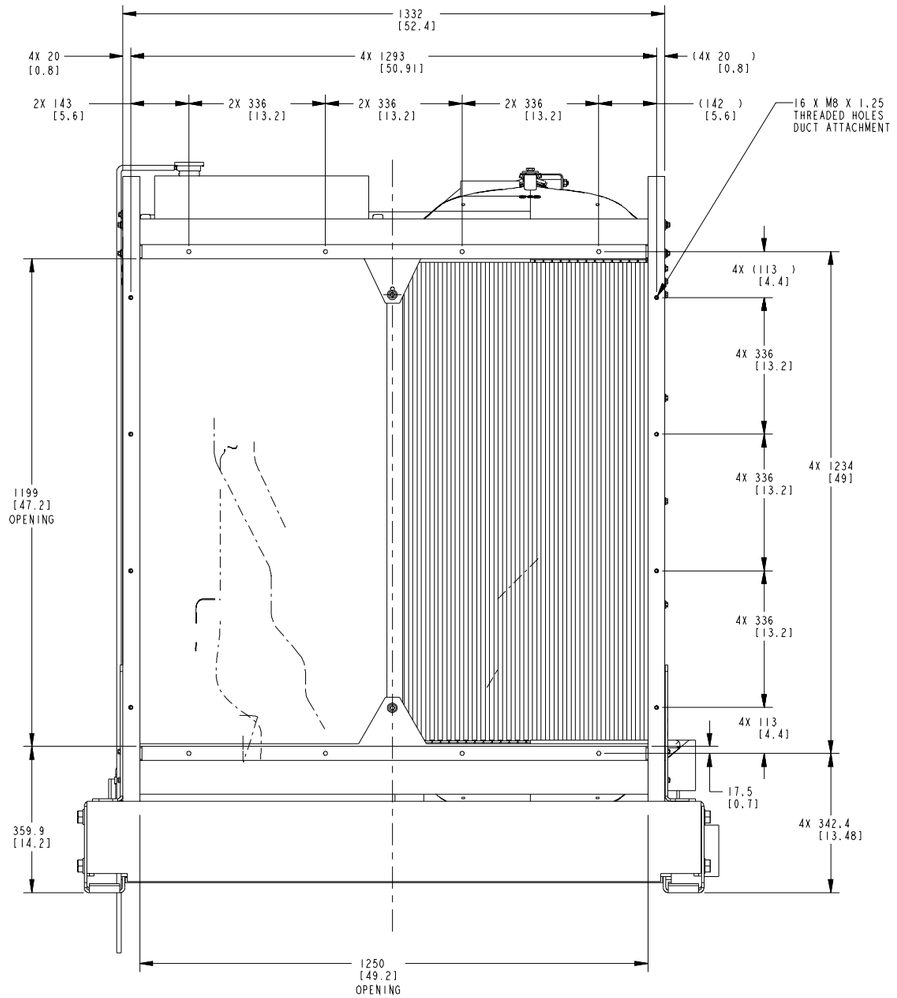
SHEET 1 of 3

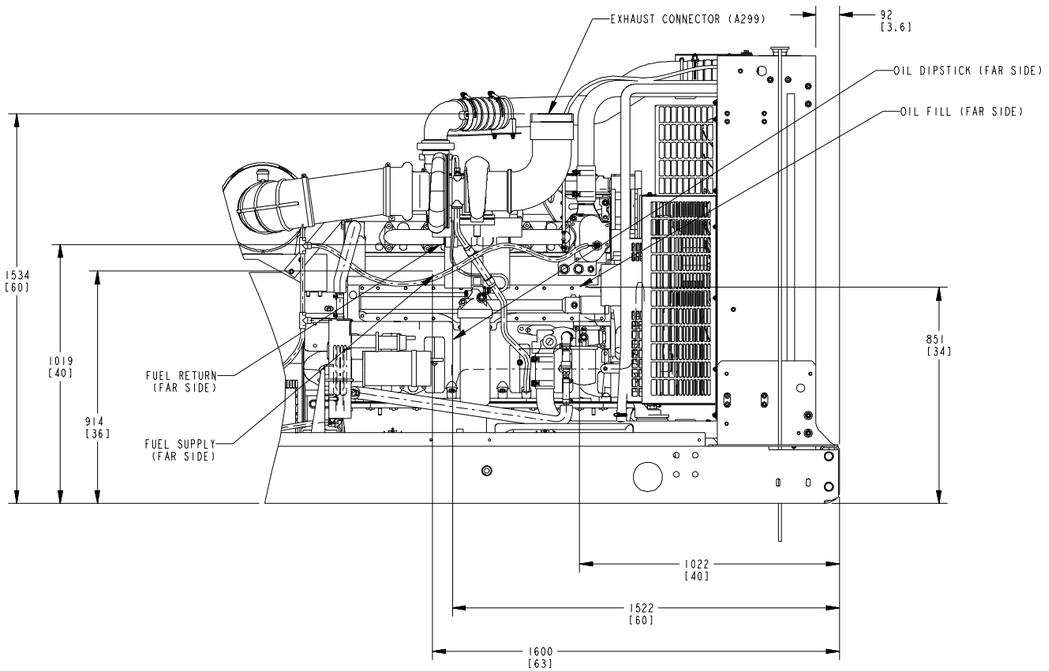
DRG SIZE D

0500_4227	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD23203	A	1	PRODUCTION_RELEASE	-	RAP	EW	E.WANG	04-20-05
FRD28410	B	-	-------	-	GJT	BG	HLS	60-29-06







MOUNTING DIMENSIONS FOR DUCT ADAPTER

SCALE ~5/32

QTY	ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED	SIM TO	
	mm: X ±1; .X ±0.8; .XX ±0.38 — inch: X ±; .XX ±; .XXX±	COPIED FROM	
ANG TOL± 1.0°	HOLE: 0.99-4.99 ±0.15/-0.08 (.004-.200 +.006/-.003); 5.00-9.99 ±0.20/-0.10 (.201-.421 +.008/-.004); 10.00-17.49 ±0.25/-0.13 (.422-.703 +.010/-.005); 17.50-24.99 ±0.30/-0.13 (.704-.999 +.012/-.005)	THIRD ANGLE PROJECTION	
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	NAME	DATE
DR	R_PAUTZKE	04-20-05
CHKR / MFG	E.WANG	04-20-05
APPROVED	E.WANG	04-20-05

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEG,EH,EJ,EK

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: GENSET_OUTLINE .

DRG NO: 0500_4227

SHEET: 2 of 3

DRG SIZE: D

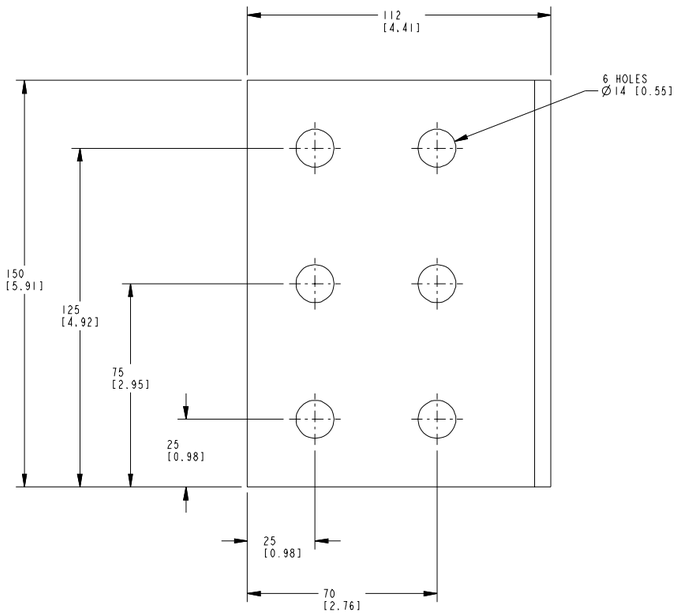
0500_4227	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD23203	A	1	PRODUCTION_RELEASE	-	RAP	EW	E.WANG	04-20-05
FRD28410	B	-	-------	-	GJT	BG	HLS	06-29-06

NOTES:

1. TERMINALS WILL ACCOMMODATE STANDARD NEMA AND IEC 2-HOLE LUGS.
2. TERMINALS WILL ACCOMMODATE UP TO 6-500 MCM LUGS.

GENERATOR OUTPUT TERMINALS
(FOR ALL HC5 ALTERNATORS)



ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

ANG TOL± 1.0°

DRAWN TO SCALE OF 1/16

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ±1 .X ±0.8 .XX ±0.38	.X ± .XX ± .XXX±
HOLE	0.00-4.99 ±0.15/-0.08 5.00-9.99 ±0.20/-0.10 10.00-17.49 ±0.25/-0.13 17.50-24.99 ±0.30/-0.13	.004-.200 +.006/-.002 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005

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MODEL FIRST USED ON: DFEG,EH,EJ,EK

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

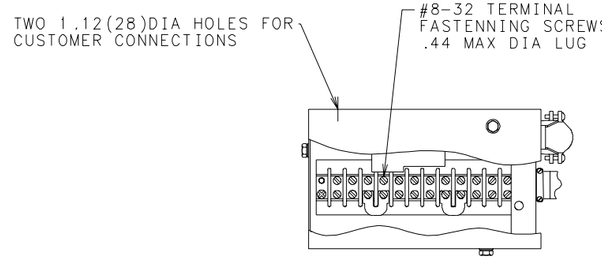
TITLE: GENSET_OUTLINE .

DRG NO: 0500_4227

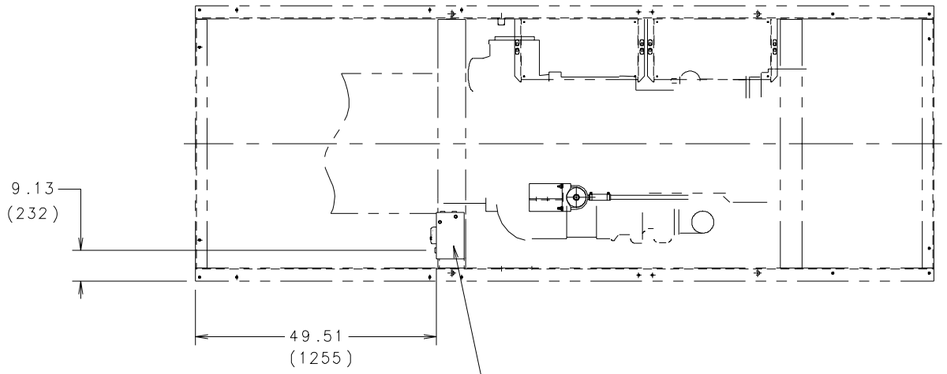
SHEET: 3 of 3

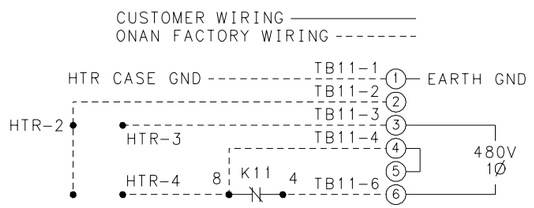
DRG SIZE: D

0500-3312 D



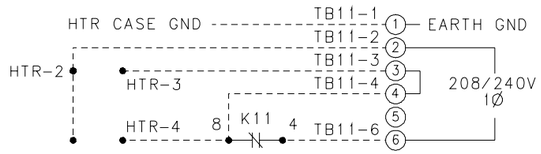
DETAIL OF HEATER TERMINAL BOX



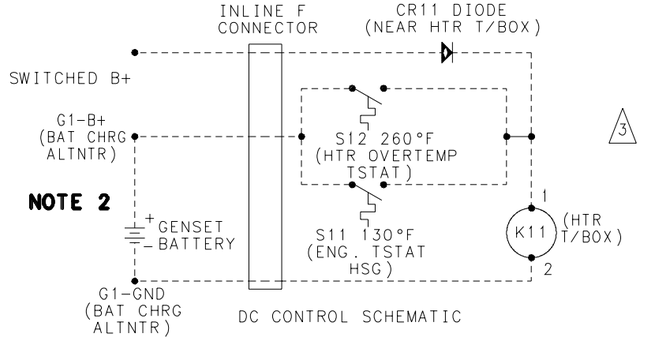


AC POWER SCHEMATIC

STANDARD 480V CONNECTION FACTORY WIRED



AC POWER SCHEMATIC
208/240V CONNECTION OPTIONAL



DC CONTROL SCHEMATIC

ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD2745	A	1	PRODUCTION RELEASE	-	JC	JSL	LENGYEL	10-05-99
FRD3612	B	1	TABLE HEADER WAS "4990W NOM HEATER"	1B	CL	BG	JSL	12-15-99
		2	TABLE HEADER WAS "6420W NOM HEATER"	1B	CL	BG	JSL	12-15-99
		3	ADDED TOTAL WATTS COLUMN	1B	CL	BG	JSL	12-15-99
		4	ADDED TOTAL WATTS COLUMN	1B	CL	BG	JSL	12-15-99
		5	RMVD NOTE 3, WAS HTR PWR IS 3744W & 4825W	2C	CL	BG	JSL	12-15-99

NOTES:

1. DIMENSIONS IN ( ) ARE MILLIMETERS.
2. THE HEATER CONTROL RELAY DRAWS 83 mA OF CURRENT WHEN THE HEATERS ARE UNPOWERED. HEATERS ARE NOT POWERED WHEN:
   1) THE ENGINE HAS REACHED DESIGN TEMPERATURE OR
   2) THE ENGINE IS RUNNING.

⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE

⚠3

⚠3

HEATER AMPERAGE TABLE

SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 ONE HEATER		FEATURE CODE H557 ONE HEATER	
	HEATER AMPS	TOTAL WATTS	HEATER AMPS	TOTAL WATTS
208	18.0	3744	23.2	4825
240	20.8	4990	26.75	6420
480	10.4	4990	13.375	6420

REVISIO DWG

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED: mm — .X ± .1, .XX ± .13, .XXX ± .127; Inch — .X ± .005, .XX ± .010, .XXX ± .005; ANG TOL ± .5°

DECIMAL	FRACTIONAL
0.00-4.99 ±0.13/-0.08	.004-.200 +.005/-.003
5.00-9.99 ±0.20/-0.10	.201-.421 +.008/-.004
10.00-17.49 ±0.25/-0.13	.422-.703 +.010/-.005
17.50-24.99 ±0.30/-0.13	.704-.999 +.012/-.005

DRAWN TO SCALE OF .08

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QTY	ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	J. CASALENDA	10-05-99
CHKR / MFG	J. LENGYEL	10-05-99
APPROVED	J. LENGYEL	10-05-99

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEH, EJ, EK

Onan — MINNEAPOLIS, MINNESOTA 55432

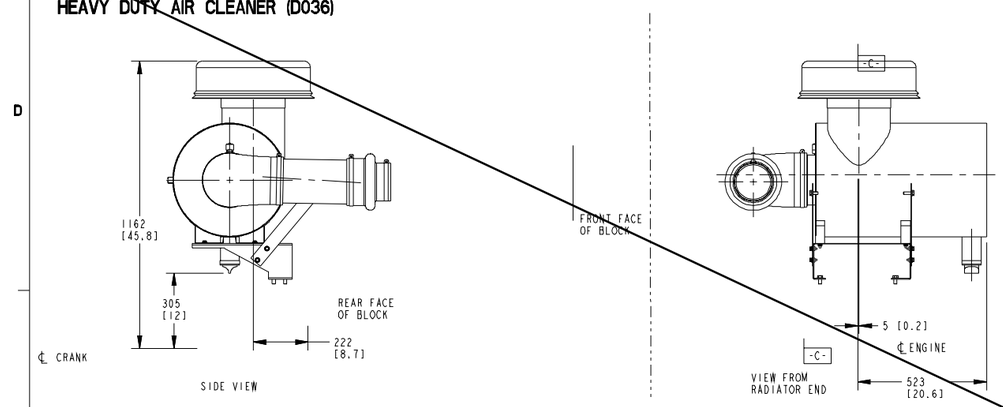
TITLE: OUTLINE-HTR INTERFACE

DWG NO. 0500-3312 — SHEET 1 of 1 — SIZE D

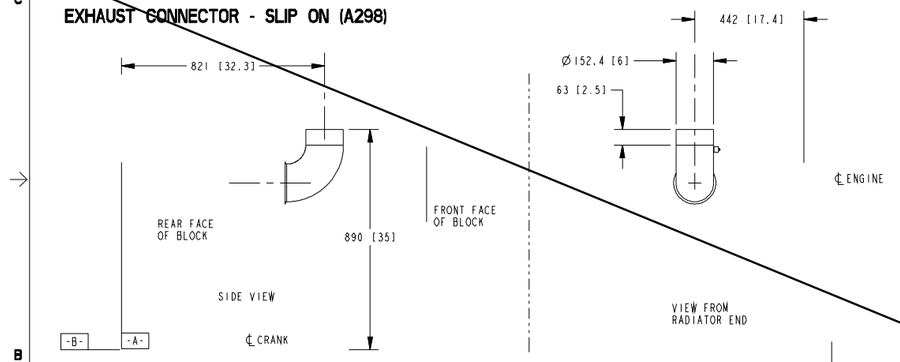
0500_4233	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD23203	A	1	PRODUCTION_RELEASE	-	RAP	EW	WANG	04-11-05
FRD24947	B	1	SEE SHEET 2	-	LA	BG	LARSON	09-27-05
		2	SEE SHEET 2	-	LA	BG	LARSON	09-27-05
		3	SEE SHEET 2	-	LA	BG	LARSON	09-27-05
		4	SEE SHEET 2	-	LA	BG	LARSON	09-27-05
		5	SEE SHEET 2	-	LA	BG	LARSON	09-27-05

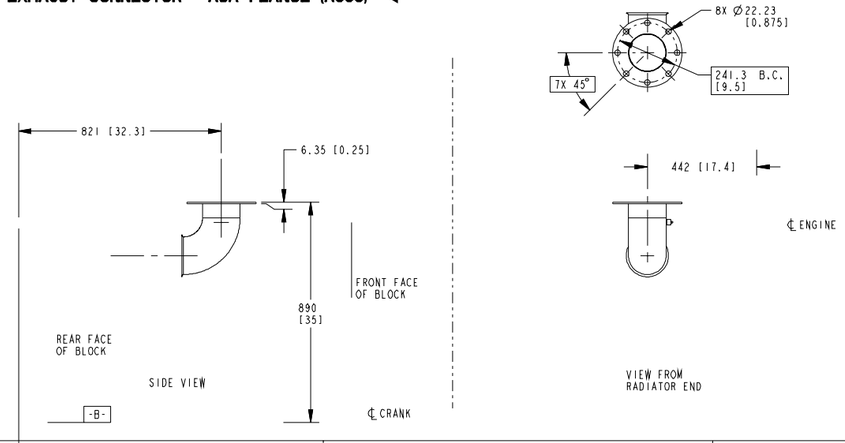
HEAVY DUTY AIR CLEANER (D036)



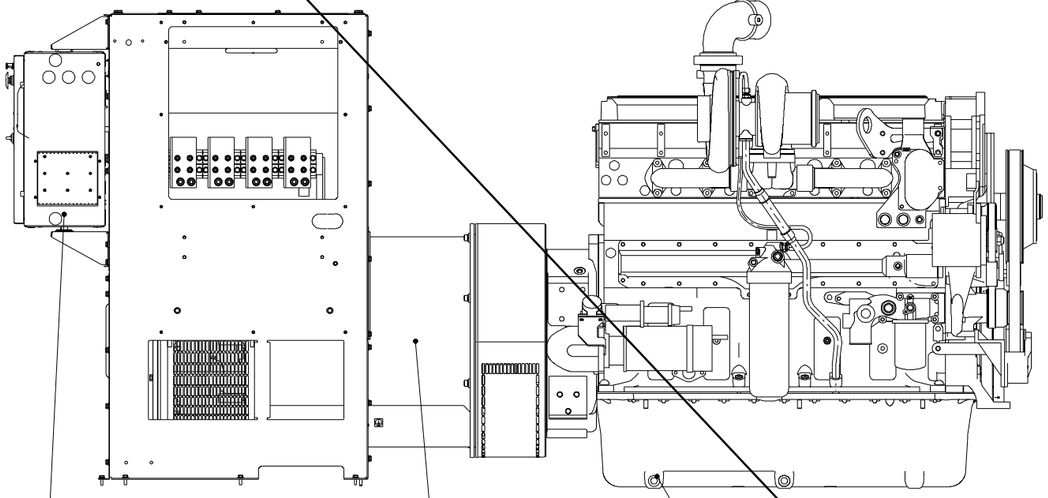
EXHAUST CONNECTOR - SLIP ON (A298)



EXHAUST CONNECTOR - ASA FLANGE (A335)



HEATERS



CONTROL CABINET HEATER

(A362):
110-125V, 150 WATTS
CONNECTION: 1830 [6 FT] CORD WITH 5-15 PLUG

(A363):
220-260V, 150 WATTS
CONNECTION: 203 [8 IN] LEADS WITH INSULATED [.25 IN] QUICK CONNECT TAB AND RECEPTACLE.

ALTERNATOR HEATER

(A292):
110-125V, 300 WATTS
CONNECTION: COMPRESSION TERMINAL BLOCK, #18 TO #12 AWG WIRE

(A293):
220-260V, 300 WATTS
CONNECTION: COMPRESSION TERMINAL BLOCK, #18 TO #12 AWG WIRE

ENGINE OIL HEATER

(H487):
120V, 450 WATTS
CONNECTION: 1830 [72 IN] CORD WITH NEMA 5-15P [11P] CORD END

DO NOT SCALE PRINT

ANG TOL ± 1.0°

DRAWN TO SCALE OF 3/32

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	Inch
	X ±1	.X ±
	.XX ±0.8	.XX ±
	.XXX ±0.38	.XXX±

HOLE	mm	Inch
	0.00-4.99 +0.15/-0.00	.004-.200 +.006/-.003
	5.00-9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 +0.30/-0.13	.704-.999 +.012/-.005

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QTY	ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	R_PAUTZKE	04-11-05
CHKR BG	E_WANG	04-11-05
APPROVED	E_WANG	04-11-05
SITE CODE	PGA	

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEG,EH,EJ,EK

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

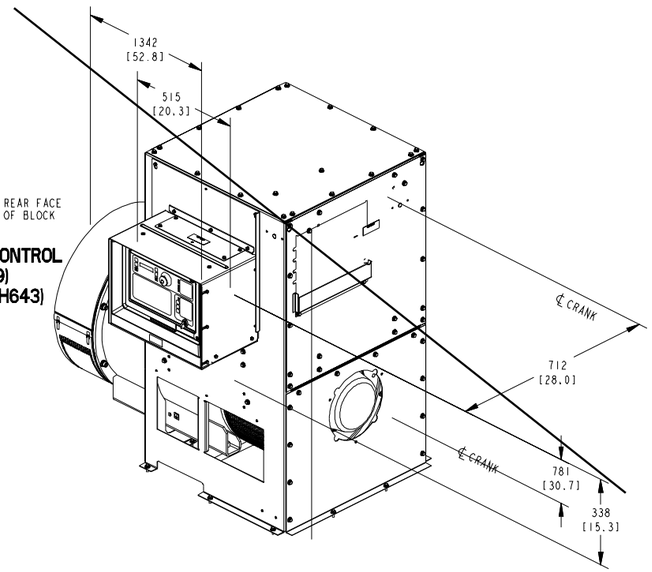
TITLE: GENSET_OUTLINE (OPTIONS)

DWG NO: 0500_4233 | SHEET 1 of 2 | DRG SIZE D

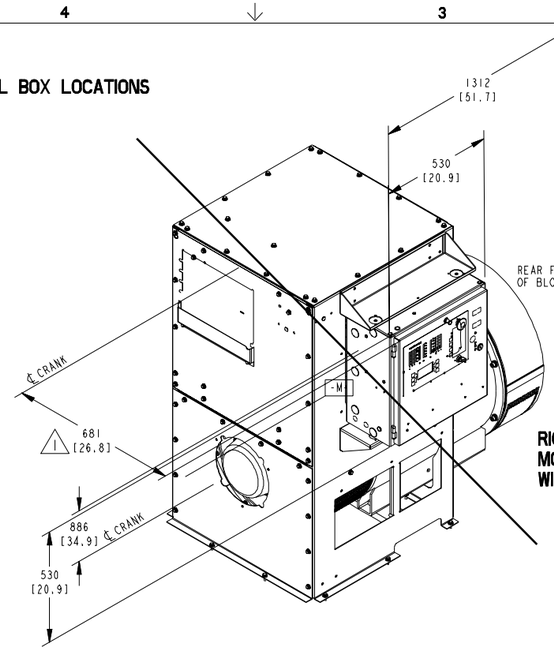
0500_4233	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD23203	A	1	PRODUCTION_RELEASE	-	RAP	EW	WANG	04-11-05
FRD24947	B	1	ADD PCC2100 TO LEFT FACING CONTROL H643	-	LA	BG	LARSON	09-27-05
		2	ADD PCC2100 TO RIGHT FACING CONTROL H643	-	LA	BG	LARSON	09-27-05
		3	ADD PCC3201 TO RIGHT FACING CONTROL H611	-	LA	BG	LARSON	09-27-05
		4	ADD PCC3201 TO LEFT FACING CONTROL H611	-	LA	BG	LARSON	09-27-05
		5	ADD PCC3201 TO FRONT FACING CONTROL H611	-	LA	BG	LARSON	09-27-05

CONTROL BOX LOCATIONS

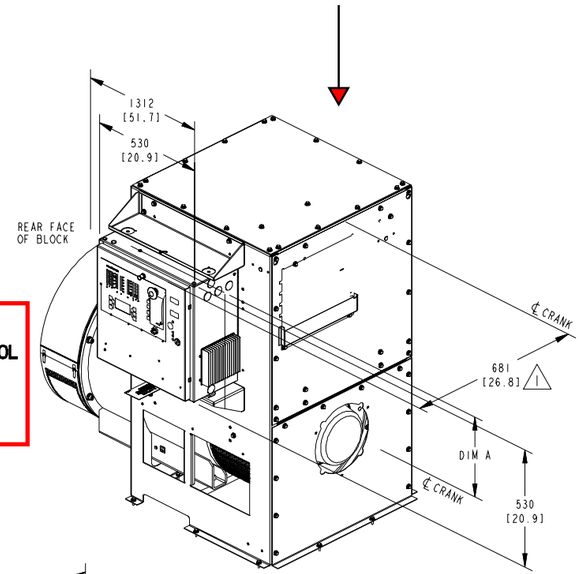


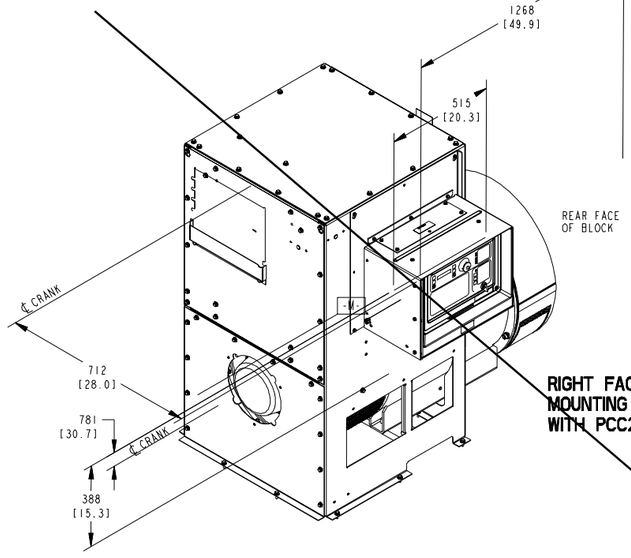
LEFT FACING CONTROL
MOUNTING (H609)
WITH PCC2100 (H643)



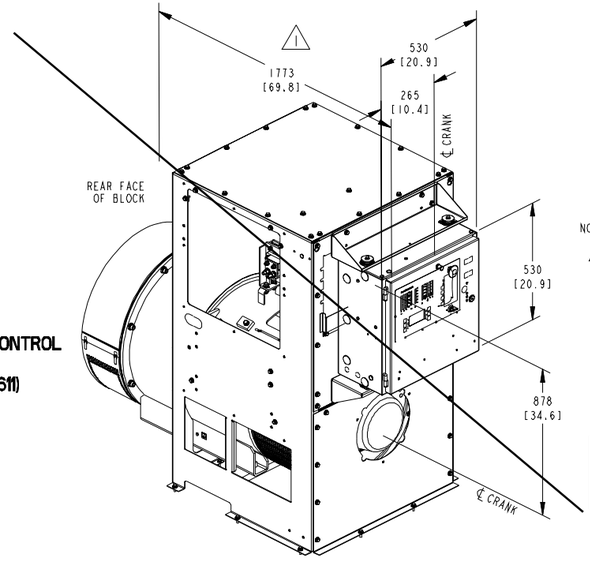
RIGHT FACING CONTROL
MOUNTING (H608)
WITH PCC3201 (H611)

LEFT FACING CONTROL
MOUNTING (H609)
WITH PCC3201 (H611)





RIGHT FACING CONTROL
MOUNTING (H608)
WITH PCC2100 (H643)



FRONT FACING CONTROL
MOUNTING (H679)
WITH PCC3201 (H611)

NOTE:
1. DIMENSION TO FACE OF CONTROL BOX. COMPONENTS ON FACE EXTEND 24 [0.9] BEYOND FACE.

DIM A	H611 APPLICATIONS
886 [34.9]	H608, H609
691 [27.2]	HOUSING OPTIONS: F200,201,202,203,204,205

ITEM	PART NO	QTY	DESCRIPTION OR MATERIAL

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ±1 .X ±0.8 .XX ±0.38	X ± .XX ± .XXX±
ANG TOL± 1.0°		
HOLE	0.99- 4.99 ±0.15/-0.08 5.00- 9.99 ±0.20/-0.10 10.00-17.49 ±0.25/-0.13 17.50-24.99 ±0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005
DRAWN TO 3/32 SCALE OF		

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	NAME	DATE
DR	R_PAUTZKE	04-11-05
CHKR MFG	E_WANG	04-11-05
APPROVED	E_WANG	04-11-05

FOR INTERPRETATION OF DIMENSIONS, TOLERANCING AND SURFACE FINISH SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEG,EH,EJ,EK

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: GENSET_OUTLINE (OPTIONS)

DRG NO: 0500_4233

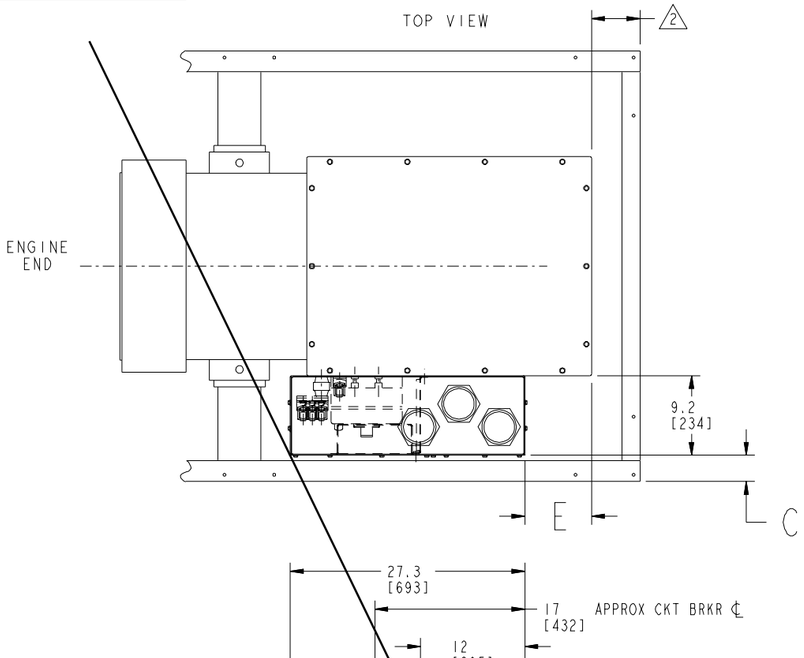
SHEET: 2 of 2

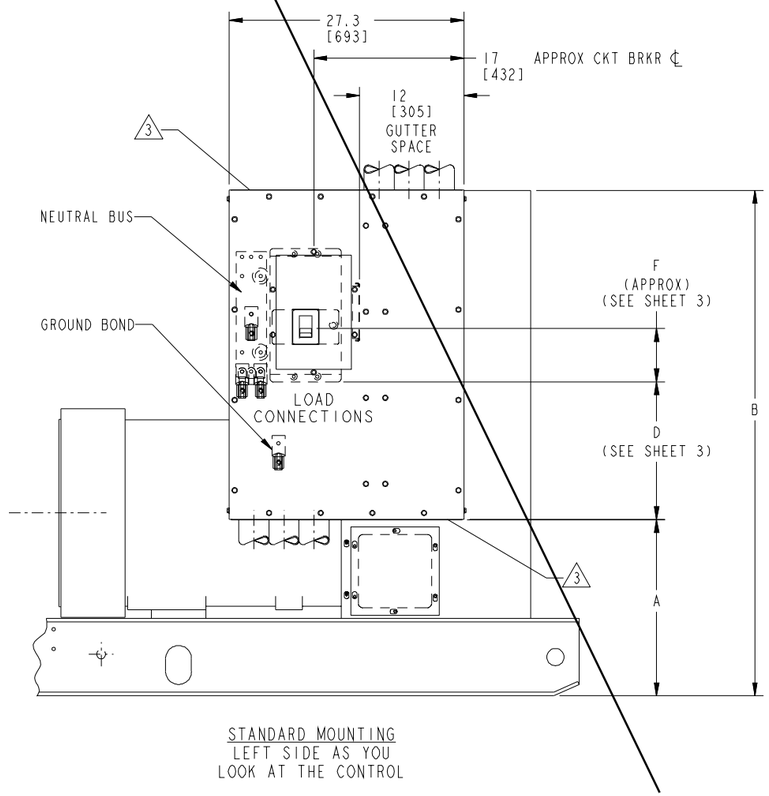
DRG SIZE: D

0500_3279

ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
77903	A	1	PRODUCTION_RELEASE	-	GAC	TAL	TAL	08-18-98
FRD3854	B	1	ADDED QSX15	1B	JMB	DDG	GILLETT	12-14-99
		2	ADDED DIM E	1C	JMB	DDG	GILLETT	12-14-99
FRD7887	C	1	TAB- ADDED MODEL DQAD, AE, AF	2C	SZR	DDG	GILLETT	12-28-00
FRD16053	D	1	DIM TAB: ADD DFEG MODEL NAME	2-B	RMM	BG	B.GROSS	03-20-03
FRD1510	E	1	ADD DIM F	4B	WP	WP	LARSON	09-29-03
		2	SEE SHEET 2	-	WP	WP	LARSON	09-29-03
FRD21012	F	1	SEE SHEET 2	-	SJG	PPL	PPL	08-17-04
FRD22374	G	1	SEE SHEET 2	-	SJG	PPL	PPL	12-08-04
		2	SEE SHEET 2	-	SJG	PPL	PPL	12-08-04
		3	SEE SHEET 2	-	SJG	PPL	PPL	12-08-04
FRD23985	H	1	ADDED QSL9	-	LA	DDG	GILLETT	06-01-05
FRD24125	J	1	ADDED SHEET 3	-	SJ	PPL	PPL	09-08-05
FRD26537	K	1	SEE ECO	-	JJJ	PPL	PPL	03-15-06
FRD28994	L	1	ADD DQHAA,DQHAB	-	DAH	LN	LN	09-12-06

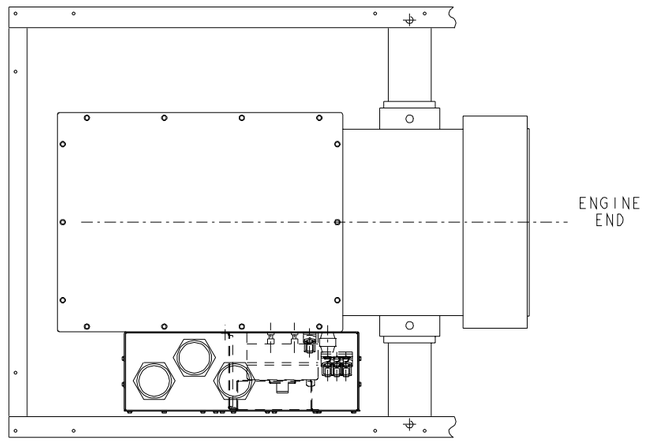
TOP VIEW

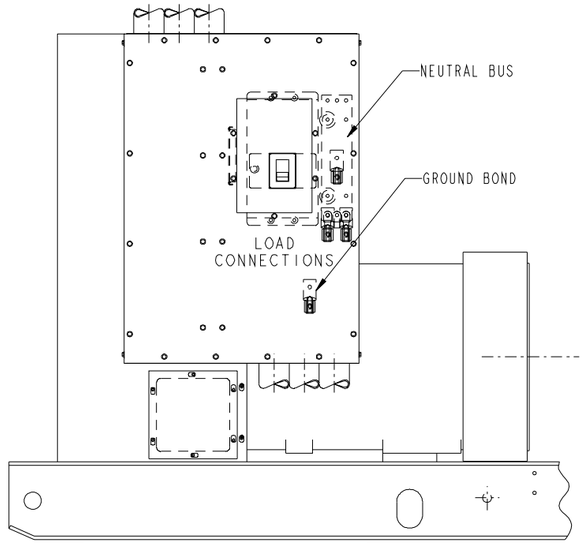




STANDARD MOUNTING
LEFT SIDE AS YOU
LOOK AT THE CONTROL

TOP VIEW





OPTIONAL MOUNTING
RIGHT SIDE AS YOU
LOOK AT THE CONTROL
CUSTOMER REQUEST ONLY

DIMENSION TABULATIONS

MODEL NAME	ENGINE SIZE	DIM A	DIM B	DIM C	DIM E
DQDAA DQDAB DQDAC	QSL9	18.2 [462]	58.8 [1493]	3.0 [77]	3.8 [97]
DFAA DFAB DFAC DQAA DQAB DQAD DQAE DQAF DQHAA DQHAB	L10/M11/ QSM11	18.2 [463]	58.8 [1494]	2.7 [69]	7.8 [198]
DFBF DFCB DFCC DFCE DQBA DQBB	855/N14	18.1 [460]	58.7 [1491]	2.1 [53]	7.8 [198]
DFEB DFEC DFED DFFB	K19	19.2 [488]	59.9 [1521]	7.4 [188]	7.8 [198]
DFGA DFGB	V28	26.1 [663]	66.8 [1696]	8.6 [218]	7.8 [198]
DFEK DFEJ DFEH DFEG	QSX15	19.9 [506]	60.5 [1537]	5.4 [137]	3.5 [90]

NOTES:

1. DIMENSIONS SHOWN IN [ ] ARE IN MILLIMETERS.
2. _____ DIMENSION IS GENERATOR FRAME SPECIFIC (REFER TO SET OUTLINE DRAWING).
3. TOP AND BOTTOM COVERS ARE ADJUSTABLE VERTICALLY PLUS OR MINUS .25" [6] TO EASE CONDUIT ATTACHMENT.

CLASSIFICATION OF CHARACTERISTICS
CRITICAL
MAJOR
MINOR (NONE)
LINE BELOW SYMBOL APPLIES TO UPPER LIMIT
LINE ABOVE SYMBOL APPLIES TO LOWER LIMIT
NO LINE WITH SYMBOL APPLIES TO BOTH LIMITS
▼ KEY INSTRUCTION (NO TOLERANCE)

APPROVED T_LOEHLEIN
DATE 08-18-98

Pro/ENGINEER

DO NOT SCALE PRINT

ANG TOL ± 1.0°

DRAWN TO SCALE OF 1/1

HOLE

DIM	TOLERANCE UNLESS OTHERWISE SPECIFIED mm	inch
X	±	.X ± 0.8
.X	±	.XX ± 0.38
.XX	±	.XXX ± 0.150
0.00- 4.99	±0.15/-0.08	.004-.200	+.006/-.003
5.00- 9.99	±0.20/-0.10	.201-.421	+.008/-.004
10.00-17.49	±0.25/-0.13	.422-.703	+.010/-.005
17.50-24.99	±0.30/-0.13	.704-.999	+.012/-.005

QTY

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ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	MAT DES
	NAME		DATE	
DR	G_COLLEEN		08-17-98	
CHKR / MFG	S_JULIK		08-18-98	
APPROVED	T_LOEHLEIN		08-18-98	

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON HC4-HC5

Onan

Minneapolis, Minnesota 55432

TITLE OUTLINE-CKT_BRKR .

DRG NO. 0500_3279

SHEET 1 of 3

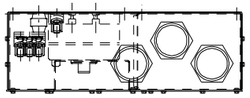
DRG SIZE D

0500_3279 D

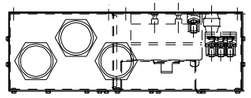
ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
77903	A	1	PRODUCTION_RELEASE	-	GAC	TAL	TAL	08-18-98
FRD3854	B	-	----------	-	---	---	---	---
FRD7887	C	-	----------	-	---	---	---	---
FRD16053	D	-	----------	-	RMM	BG	B.GROSS	03-20-03
FRD1510	E	2	ADD DIM F TO UL/IEC LUG TABULATION	3D	WP	WP	LARSON	09-29-03
FRD21012	F	1	ADD "P" FRAME INFORMATION TO UL/IEC					
			LUG TABULATION	4-C	SJG	PPL	PPL	08-17-04
		2	ADDED NOTE 5	4-A	SJG	PPL	PPL	08-17-04
FRD22374	G	1	FRAME NSF DIM F IN TAB WAS 25.2 [640]	3-D	SJG	PPL	PPL	12-08-04
		2	FRAME NSJ DIM F IN TAB WAS 26.3 [669]	3-C	SJG	PPL	PPL	12-08-04
		3	FRAME CK DIM F IN TAB WAS 24.4 [621]	3-C	SJG	PPL	PPL	12-08-04
FRD23985	H	-	----------	-	---	---	---	---
FRD24125	J	-	----------	-	-	-	-	-
FRD26537	K	1	SEE ECO	-	JJJ	PPL	PPL	03-15-06
FRD28994	L	-	--------	-	DAH	LN	LN	09-12-06

RECOMMENDED LOCATIONS FOR ONE, TWO OR THREE CONDUITS (3 1/2" CONDUIT SHOWN)

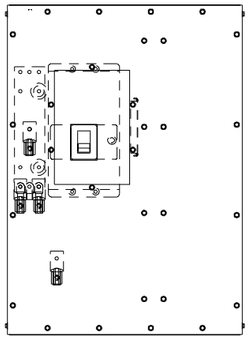
TOP ENTRANCE BOX



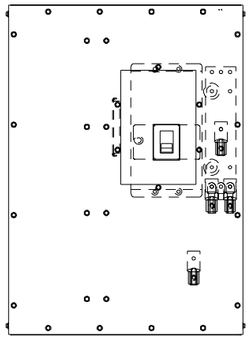
LEFT



RIGHT

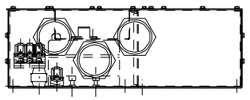


LEFT

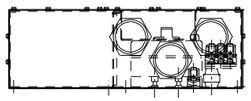


RIGHT

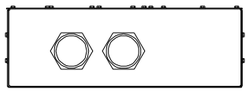
BOTTOM ENTRANCE BOX



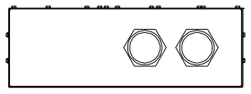
THREE CONDUIT



THREE CONDUIT



TWO CONDUIT



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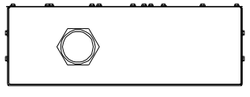
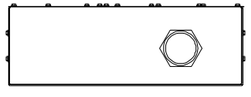


ONE CONDUIT



ONE CONDUIT

MAX BRKR AMPS	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
1200A	3	500 KCMIL	3	3 1/2"
1000A	3	400 KCMIL	3	3 1/2"
800A	2	500 KCMIL	2	3 1/2"
630A	2	300 KCMIL	2	3"
400A	1	500 KCMIL	1	3 1/2"
250A	1	250 KCMIL	1	3"
100A	1	2	1	1 1/2"

(2) TYPICAL CONDUIT AND WIRE SIZE BASED ON NEC TABLE 310-16 AT 25°C

NOTES:

(2) THESE WIRE-CONDUIT COMBINATIONS MEET NEC AND CEC. TO USE OTHER COMBINATIONS, REFER TO APPLICABLE CODES TO ENSURE THAT WIRE AMPACITY, BEND SPACE AND GUTTER SPACE MEET THE REQUIREMENTS.

(3) THESE SHUNT TRIP UNITS CAN BE OPERATED AT 75% OF NOMINAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.

(4) "NS" SHUNT TRIP HAS NO INTERNAL CONTACTS, IT MUST BE USED IN CONJUNCTION WITH AUXILIARY CONTACTS TO ACCEPT CONTINUOUS APPLIED VOLTAGE. IT CAN OPERATE AT 75% OF NOMINAL VOLTAGE.

(F2) (5) THE SHUNT TRIP CAN OPERATE AT 70% TO 100% OF NORMAL VOLTAGE AND WILL ACCEPT MOMENTARY OR CONTINUOUS APPLIED VOLTAGE.

CLASSIFICATION OF CHARACTERISTICS
CRITICAL ●
MAJOR ◐
MINOR (NONE)
LINE BELOW SYMBOL ● APPLIES TO UPPER LIMIT
LINE ABOVE SYMBOL ● APPLIES TO LOWER LIMIT
NO LINE WITH SYMBOL APPLIES TO BOTH LIMITS
▼KEY INSTRUCTION (NO TOLERANCE)

APPROVED T_LOEHLEIN
DATE 08-18-98

Pro/ENGINEER

DO NOT SCALE PRINT

ANG TOL± 1.0°

DRAWN TO SCALE OF 1/1

DIM	TOLERANCE UNLESS OTHERWISE SPECIFIED mm	inch
	X ±	.X ± 0.8
	.X ±	.XX ± 0.38
	.XX ±	.XXX± 0.150
MISC	0.99- 4.99 ±0.15/-0.08	.004-.200 +.006/-.003
	5.00- 9.99 ±0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 ±0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 ±0.30/-0.13	.704-.999 +.012/-.005

SIM TO .
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THIRD ANGLE PROJECTION

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ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	NOT REQ

NAME		DATE
DR	G_COLLEEN	08-17-98
CHKR ☐ MFG ☐	S_JULIK	08-18-98
APPROVED	T_LOEHLEIN	08-18-98

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON HC4-HC5

Onan

Minneapolis, Minnesota 55432

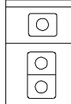
TITLE OUTLINE-CKT_BRKR .

DRG NO. 0500_3279

SHEET 2 of 3

DRG SIZE D

REL NO	LTR	NO	REVISION	ZONE	DRN	CKD	APVD	DATE
FRD24125	J	1	ADDED H & J LUGS TO TABLE	5A	SJ	PPL	PPL	09-08-05
FRD26537	K	1	SEE ECO	-	JJJ	PPL	PPL	03-15-06
FRD28994	L	-	--------	-	DAH	LN	LN	09-12-06

UL/IEC LUGS						ACCESSORY SPECIFICATIONS			
LUG	FRAME	MAX AMPS	WIRE RANGE COPPER	DIM D	DIM F	ACCESSORY DESCRIPTION	CONTACT RATING	INRUSH CURRENT	CONNECTION TYPE
	NSF	15-60A	#14-10 AWG (SOLID COND. ONLY)	21.1 [535]	4.1 [104]	24 VDC SHUNT TRIP	-	10A (4)	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
		70-250A	2/0-250 KCMIL			1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	6A AT 690 VAC 2.5A AT 48 VDC, 0.3A AT 250 VDC	-	
	NSJ	400A 3 OR 4 POLE	#2-600 KCMIL	19.4 [493]	6.9 [175]	24 VDC SHUNT TRIP	-	10A (4)	COMPRESSION TERMINALS #20-16 AWG OR SMALLER TORQUE: 10 LB-IN
		600A 3-POLE 630A 4-POLE	2/0-350 KCMIL			1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	6A AT 690 VAC 2.5A AT 48 VDC, 0.3A AT 250 VDC	-	
	CK	800A 3-POLE 800A 4-POLE 1200A 3-POLE 1250A 4-POLE	3/0-500 KCMIL	15.4 [391]	9.0 [229]	24 VDC SHUNT TRIP	-	3A (3)	COMPRESSION TERMINALS FOR 1 OR 2 #18-14 AWG. TORQUE: 12 LB-IN
						1 EA. FORM C 1 AUX CONTACT + 1 TRIP ALARM	5A AT 480 VAC, 3A AT 600 VAC 0.5A AT 125 VDC, 0.25A AT 250 VDC	-	
	P	800A 3-POLE	3/0-500 KCMIL	18.9 [480]	7.0 [177]	24 VDC SHUNT TRIP	-	200VA (5)	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
						1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VDC	-	
	P	1200A 3-POLE	3/0-500 KCMIL	17.2 [437]	8.7 [220]	24 VDC SHUNT TRIP	-	200VA (5)	COMPRESSION TERMINALS FOR 1 OR 2 #18-16 AWG. TORQUE: 10 LB-IN
						1 EA. FORM C 4 AUX CONTACTS + 1 TRIP ALARM	6A AT 240 VAC, 6A AT 480 VAC, 3A AT 600 VAC, 2.5A AT 48 VDC, 0.8A AT 125 VDC, 0.3A AT 250 VAC	-	
	H	15-150	(1) #14-3/0 AWG	21.7 [545]	3.8 [95]	24 VDC SHUNT TRIP	COIL BURDEN < 5W	10A (4)	COMPRESSION TERMINALS #14 - #10 AWG 50 LB-IN #8-3/0 120 LB-IN
	J	175	(1) 1/0-4/0 AWG	21.2 [535]	4.1 [104]	1 EA FORM C 1 AUX CONTACT + 1 TRIP ALARM	MIN LOAD = 10 ma WITH 24V DC: 48 2.5A, 125 0.8A, 250 0.3A; AC: 240 6.0A, 480 6.0A, 600 3.0A	-	COMPRESSION TERMINALS 3/0-350 KCMIL 225 LB-IN
		200-250	(1) 3/0-350 kcmil						

QTY	ITEM	PART NO	DESCRIPTION OR MATERIAL

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

DIM: X ±1; .X ±0.8; .XX± 0.38

HOLE: 0.00- 4.99 +0.15/-0.08; 5.00- 9.99 +0.20/-0.10; 10.00-17.49 +0.25/-0.13; 17.50-24.99 +0.30/-0.13

ANG TOL: ± 1.0° SCALE: 1/1

SIM TO .

DO NOT SCALE PRINT

- CONFIDENTIAL - PROPERTY OF CUMMINS POWER GENERATION GROUP

DRN G_COLLEEN

CHD S_JULIK

APVD T_LOEHLEIN

DATE 08-17-98

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ASME Y14.5M-1994

FIRST USED ON HC4-HC5

CUMMINS POWER GENERATION
1400 73RD AVENUE NE, MINNEAPOLIS, MN 55432

OUTLINE-CKT_BRKR

SITE CODE PGF

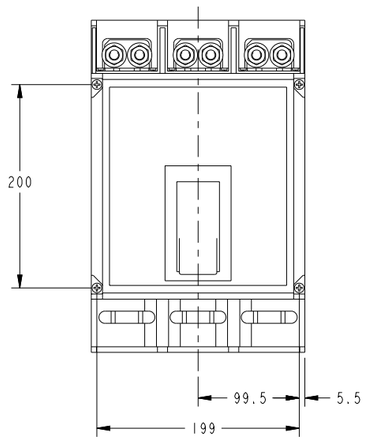
DRG SIZE D | 0500_3279 | SHEET 3 of 3 | DRG REV L

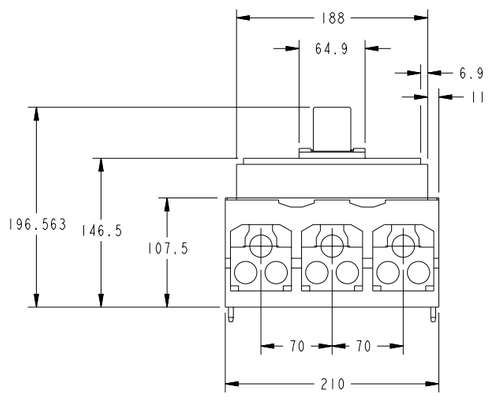
Pro/ENGINEER

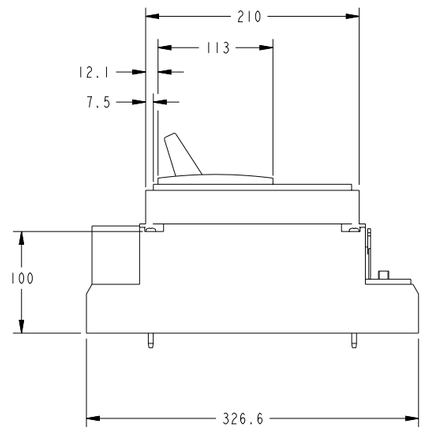
0320-2182 was exported on: Aug 20 2003 and is an Un-Controlled Document

0320_2182	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16140	A	1	PRODUCTION_RELEASE	-	DC	EC	EC	03-21-03
FRD16280	B	1	3.0 TRIP WAS 5.0 TRIP. ADD (LI).	2D	DC	EC	EC	04-08-03
		2	CHANGE TABLE	2C	DC	EC	EC	04-08-03
		3	PJ WAS PG	2B	DC	EC	EC	04-08-03







NOTES:

1. THIS PART IS VENDOR SOURCE CONTROLLED.
2. (B1) ELECTRONIC TRIP CIRCUIT BREAKER. STANDARD MICROLOGIC 3.0 TRIP UNIT. (LI).
3. BREAKERS TO BE SUPPLIED WITH TYPE F PLUG.

TYPE F PLUG AMPERAGE SETTINGS									
TYPE F	84%	86%	88%	90%	92%	94%	96%	98%	100%
0320-2182	672	688	704	720	736	752	768	784	800

4. BREAKERS TO BE SUPPLIED WITH STABS ON LINE/TOP SIDE AND WITH LUGS ON LOAD/BOTTOM SIDE.
5. AGENCIES: 3 POLE UL LISTED
   IEC
6. INTERRUPTING RATING

(B2)

	UL/CSA/NMX			IEC	
	240 Vac	480 Vac	600 Vac	240 Vac	415Y/240Vac
PJ	100kA	65kA	25kA	65kA	50kA

(B3)

PRODUCTION P/N	BREAKER	POLES	VOLTS UL/(IEC)	PLUG TYPE
0320_2182	PJ800	3	600 (690)	F

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED				SIM TO .	.
	DIM	mm		Inch	COPIED FROM .	.
		X ± 1		.X ±		
		.X ± 0.8		.XX ±	THIRD ANGLE PROJECTION	
		.XX ± 0.38		.XXX±		
ANG TOL± 1.0 °	HOLE	0.00- 4.99	+0.15/-0.00	.004-.200	+.006/-.003	
		5.00- 9.99	+0.20/-0.10	.201-.421	+.008/-.004	
DRAWN TO SCALE OF 3/8		10.00-17.49	+0.25/-0.13	.422-.703	+.010/-.005	
		17.50-24.99	+0.30/-0.13	.704-.999	+.012/-.005	

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ITEM	PART NO	DRG SIZE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	D CRANE	03-21-03
CHKR	E_CZECHOWSKI	03-21-03
MFG		
APPROVED	E_CZECHOWSKI	03-21-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSY Y14.5M-1982

MODEL FIRST USED ON: HC6/HC7

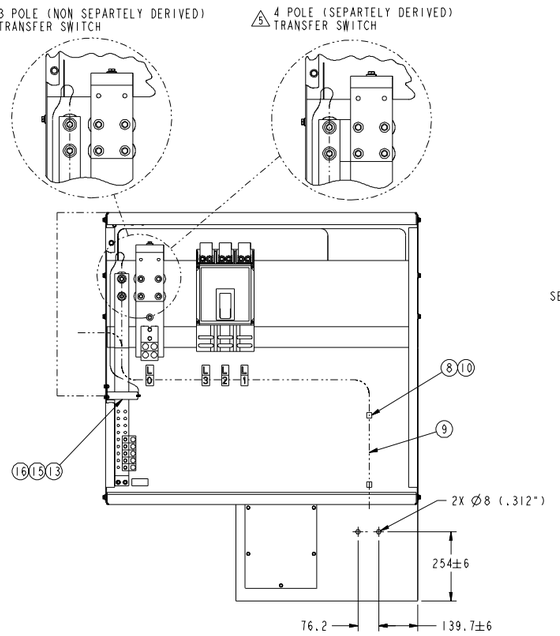
SITE CODE: PGA

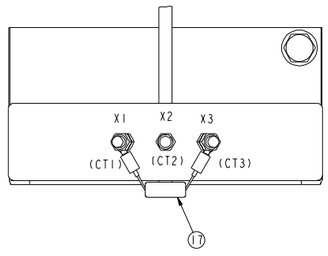
CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

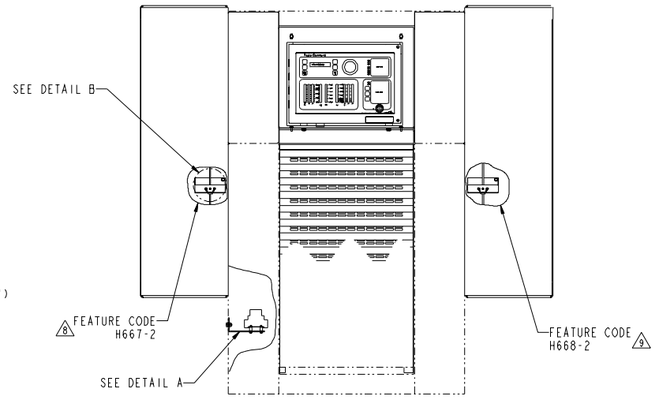
TITLE: CIRCUIT_BREAKER (800A)

DRG NO: 0320_2182 SHEET 1 of 1 DRG SIZE D

0179_3509	E	Pro/ENGINEER	METRIC DWG







14. INSTALL JUMPER (PROVIDED WITH HARNESS) BETWEEN GROUND FAULT RELAY TERMINALS 4 & 5. REMOVE WIRE TIE IF NECESSARY.

15. FOR CUSTOMER INSTALLATION OF CURRENT TRANSFORMER-WARNIIG-INCORRECT INSTALLATION OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY. DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND MECHANICAL SERVICE PER LOCAL CODES AND STANDARDS.

16. FOR CUSTOMERS INSTALLATION OF CURRENT TRANSFORMER-CAUTION-POTENTIALLY LETHAL VOLTAGES MAY APPEAR ON TERMINALS OF CT IF NOT ELECTRICALLY CONNECTED TOGETHER WHEN INSTALLING ON TO AN ENERGIZED SYSTEM. IT IS IMPERATIVE THAT LEADS AND/OR TERMINALS BE SHORTED TOGETHER OR ATTACHED TO THE INTEDED BURDEN PRIOR TO SUCH INSTALLATION.

17. FOR CUSTOMER INSTALLATION OF CURRENT TRANSFORMER-CAUTION-CT CAN BE SPLIT APART AND REASSEMBLED ONTO THE PRIMARY CONDUCTOR WITHOUT INTERRUPTING SERVICE. SAFTEY PRECAUTIONS MUST BE OBSERVED.

REL NO	LTR	NO	REVISION	ZONE	BY	CHKR	APPROVED	DATE
FRD16251	A	1	PRODUCTION RELEASE	-	RH	EK	EK	04-07-03
FRD16495	B	1	ADD ITEM 17, 0338-4386	2B	DC	EC	EC	05-09-03
		2	UPDATE NOTE 7.	2B	DC	EC	EC	05-09-03
FRD16933	C	1	ADD 0179_3509_03	1B	DC	EC	EC	06-06-03
		2	ADD 0179_3509_04	1B	DC	EC	EC	06-06-03
		3	ADD ITEM 18, 000C_0656	2A	DC	EC	EC	06-06-03
		4	ADD NOTE 10	1C	DC	EC	EC	06-06-03
		5	ADD P6/7 VIEW	2A	DC	EC	EC	06-06-03
		6	REVISE -01 DESC. 4 POLE WAS 3 POLE	1B	DC	EC	EC	06-06-03
FRD17149	D	1	ADD TABLE	2B	RH	EC	EC	07-02-03
		2	ADD NOTE 11	1C	RH	EC	EC	07-02-03
FRD17784	E	1	UPDATE GROUND FAULT INSTL SEE ECOR	-	DC	EC	EC	08-19-03
FRD17850	F	1	UPDATE SCHEMATICS - SEE ECOR	-	GWH	DDG	GILLETT	09-11-03
FRD18343	G	1	ADDED _07 & _08 TO NOTE 10	1C	MTA	EC	EC	10-13-03
		2	ADDED SIGNAL RETURN PCC3200 ONLY	4A	MTA	EC	EC	10-13-03
		3	ADDED SIGNAL RETURN	3A	MTA	EC	EC	10-13-03
FRD18712	H	1	ADD NOTE 13	2C	DC	EC	EC	11-20-03
FRD18823	J	1	ITEM 14 WAS 0315_1605_02	2A	DC	EC	EC	12-05-03
		2	ADD ITEM 18 (QTY 1) -02, -06	2A	DC	EC	EC	12-05-03
		3	UPDATE NOTES	-	DC	EC	EC	12-05-03
FRD20864	K	1	ADDED A SECTION VIEW FOR RELAY	2B	MTA	BH	BH	11-29-04
		2	ADDED RELAY LOCATION NOTES	2B	MTA	BH	BH	11-29-04
FRD34611	L	1	GROUND FAULT CHANGES, SEE ECO	-	GJT	BG	NARYAKSILPA	12-03-07

NOTES:

1.

2. SEE DETAIL A FOR MOUNTING GROUND FAULT RELAY.

3. INSTALL CABLE TIE MOUNTS (0332-2420) TO INSIDE OF HOUSING APPROXIMATELY 10-12 INCHES APART AS SHOWN.

4. SECURE RELAY HARNESS (0338-4368) TO CABLE TIE MOUNTS AND ENGINE HARNESS USING WIRE TIES (0332-1445) AS SHOWN.

⑤ 0179-3509-01, -03, -05, -07 IS USED WITH A 4 POLE SEPARATELY DERIVED TRANSFER SWITCH. NEUTRAL AND GROUND ARE BONDED IN THE CIRCUIT BREAKER BOX BY ROTATION OF PN 0337-3625 90° COUNTER CLOCKWISE. INSTALL CAUTION TAG (0098-6943) ON THE GROUND BAR.

⑥ 0179-3509-02, -04, -06, AND -08 ARE USED WITH A 3 POLE NON SEPARTELY DERIVED TRANSFER SWITCH. CURRENT TRANFORMER INSTALLATION (0179-3679) IS TO BE FURNISHED LOOSE AND BAGGED, TO BE LOOSE INSTALLED IN THE CUSTOMERS NEUTRAL TO GROUND BOND. NEUTRAL IS NOT BONDED TO GROUND IN CIRCUIT BREAKER BOX. INSTRUCTION ASSEMBLY SHEET (000C-0656) ALSO TO BE SUPPLIED LOOSE.

(B2) 7. HARNESS-METER (PN 0338-4386) TO BE INSTALLED ONTO CURRENT TRANSFORMER TERMINALS AS SHOWN IN DETAIL B.

⑧ H667-2 WILL HAVE THE CURRENT TRANSFORMER PN 0315-1605-01 INSTALLED IN THE LEFT SIDE OF THE CIRCUIT BREAKER ASSEMBLY.

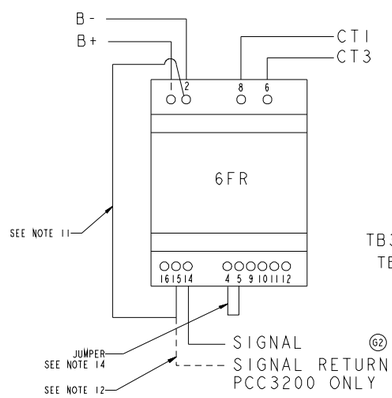
⑨ H668-2 WILL HAVE THE CURRENT TRANSFORMER PN 0315-1605-01 INSTALLED ON THE RIGHT SIDE OF THE CIRCUIT BREAKER ASSEMBLY.

(G1)(C4) 10. 0179_3509_03, _04, _07 & _08 ARE KITS FOR ACCESSORIES USE ONLY AND MUST INCLUDE THE INSTRUCTION-ASSEMBLY SHEET (000C_0656) AND A PRINT OF THE GROUND FAULT INSTALLATION DRAWING 0179_3509.

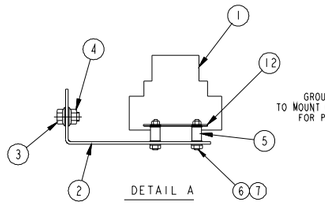
(D2) 11. JUMPER GFR-2 TO GFR-15 TO BE USED ON PCC 2100 AND PCC 3100 ONLY. JUMPER TO BE REMOVED FROM HARNESS-RELAY (0338-4368) FOR PCC 3200.

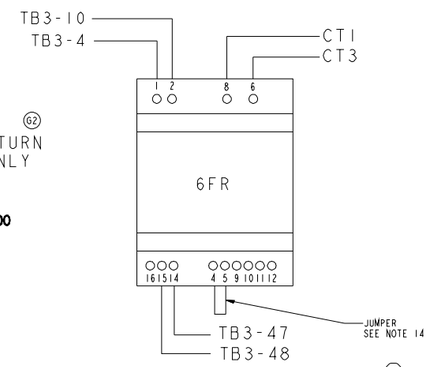
12. FOR PCC2100 AND PCC3100 THE SIGNAL RETURN IS NOT USED AND SHOULD BE TIED BACK OUT OF THE WAY ON HARNESS-RELAY (0338-4368).

(H1) 13. DOMINION (PCC3201) CONTROL WITHOUT PARALLELING OPTIONS:
-CONNECT LEAD MARKED TB3-47 ON PCC3201 TERMINAL TB3-14
-CONNECT LEAD MARKED TB3-48 ON PCC3201 TERMINAL TB3-17

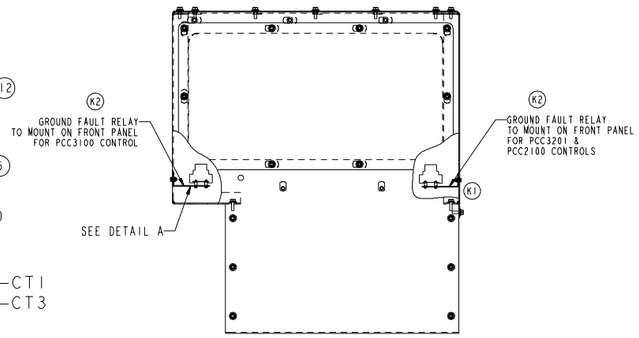


SCHEMATIC FOR PCC 2100, PCC 3100, AND PCC 3200 0179-3509-01/-02/-03/-04





SCHEMATIC FOR PCC 3201 0179-3509-05/-06/-07/-08



(C5) **P6/7 (LEFT SIDE VIEW)**

(D1)

TABULATION	
PART NO.	CURRENT_ER
0179_3509_01	FRD34611
0179_3509_02	FRD34611
0179_3509_03	FRD34611
0179_3509_04	FRD34611
0179_3509_05	FRD34611
0179_3509_06	FRD34611
0179_3509_07	FRD34611
0179_3509_08	FRD34611

	PCC2200 C.R. ACCESSORY KIT FOR USE WITH 3 POLE NON SEPERATELY DERIVED TRANSFER SWITCH	PCC2200 C.R. ACCESSORY KIT FOR USE WITH 4 POLE SEPERATELY DERIVED TRANSFER SWITCH	PCC2200 C.R. FOR USE WITH 3 POLE NON SEPERATELY DERIVED TRANSFER SWITCH	PCC2200 C.R. FOR USE WITH 4 POLE SEPERATELY DERIVED TRANSFER SWITCH	ACCESSORY KIT FOR USE WITH 3 POLE NON SEPERATELY DERIVED TRANSFER SWITCH	ACCESSORY KIT FOR USE WITH 4 POLE SEPERATELY DERIVED TRANSFER SWITCH	FOR USE WITH 3 POLE NON SEPERATELY DERIVED TRANSFER SWITCH	FOR USE WITH 4 POLE SEPERATELY DERIVED TRANSFER SWITCH	ITEM	PART NO.		DESCRIPTION OR MATERIAL
	(C2)				(C1)			(C6)				
	1	1	1	1	-	-	-	-	19	0338-4408	D	HARNESS-RELAY
(J2)(C3)	1	1	1	-	1	1	1	-	18	000C_0656	-	INSTRUCTION-ASSEMBLY SHEET
(B1)	1	1	1	1	1	1	1	1	17	0338-4386	B	HARNESS-METER (RESISTOR)
	2	2	2	2	2	2	2	2	16	0870.0212	-	NUT-SELF (1/4-20)
	2	2	2	2	2	2	2	2	15	0821.0010	-	SCREW-LK (1/4-20 X 1/2)
(J1)	1	-	1	-	1	-	1	-	14	0179_3679	D	TRANSFORMER-INSTL
	-	1	-	1	-	1	-	1	13	0315_1605_01	D	TRANSFORMER-CURRENT
	1	1	1	1	1	1	1	1	12	0319_5038_02	C	PLATE-MOUNTING (RELAY)
	-	1	-	1	-	1	-	1	11	0098_6943	A	TAG-CAUTION
	4	4	4	4	4	4	4	4	10	0332_2420	-	MOUNT-CABLE TIE
	-	-	-	-	1	1	1	1	9	0338_4368	D	HARNESS-RELAY
	AR	AR	AR	AR	AR	AR	AR	AR	8	0332_1445	A	TIE-WIRE
	8	8	8	8	8	8	8	8	7	0870.0221	-	NUT-HEX W/ET (#8-32)
	8	8	8	8	8	8	8	8	6	0853.0005	-	WASHER-ET LK (#8)
	4	4	4	4	4	4	4	4	5	0402_0354	A	MOUNT-SHOCK
	2	2	2	2	2	2	2	2	4	0870.0257	-	NUT-SELF (5/16-18)
	2	2	2	2	2	2	2	2	3	0821.0017	-	SCREW-LK (5/16-18 X 1/2)
	1	1	1	1	1	1	1	1	2	0301_6987	B	BRACKET-WATTS X9CR
	1	1	1	1	1	1	1	1	1	0307_3003_01	D	RELAY-GROUND FAULT
	QTY 10	QTY 11	QTY 10	QTY 11	QTY 11	QTY 12	QTY 11	QTY 12	ITEM	PART NO.		DESCRIPTION OR MATERIAL

DO NOT SCALE PRINT		R HALVERSON	04-07-03
		E KROHNFELDT	04-07-03
ANG TOL± 1.0 °	APPROVED	E KROHNFELDT	04-07-03
DRAWN TO SCALE OF 2/1			

CUMMINS POWER GENERATION

SITE CODE

TITLE: GROUND_FAULT_INSTL

PGA

DWG NO 0179_3509

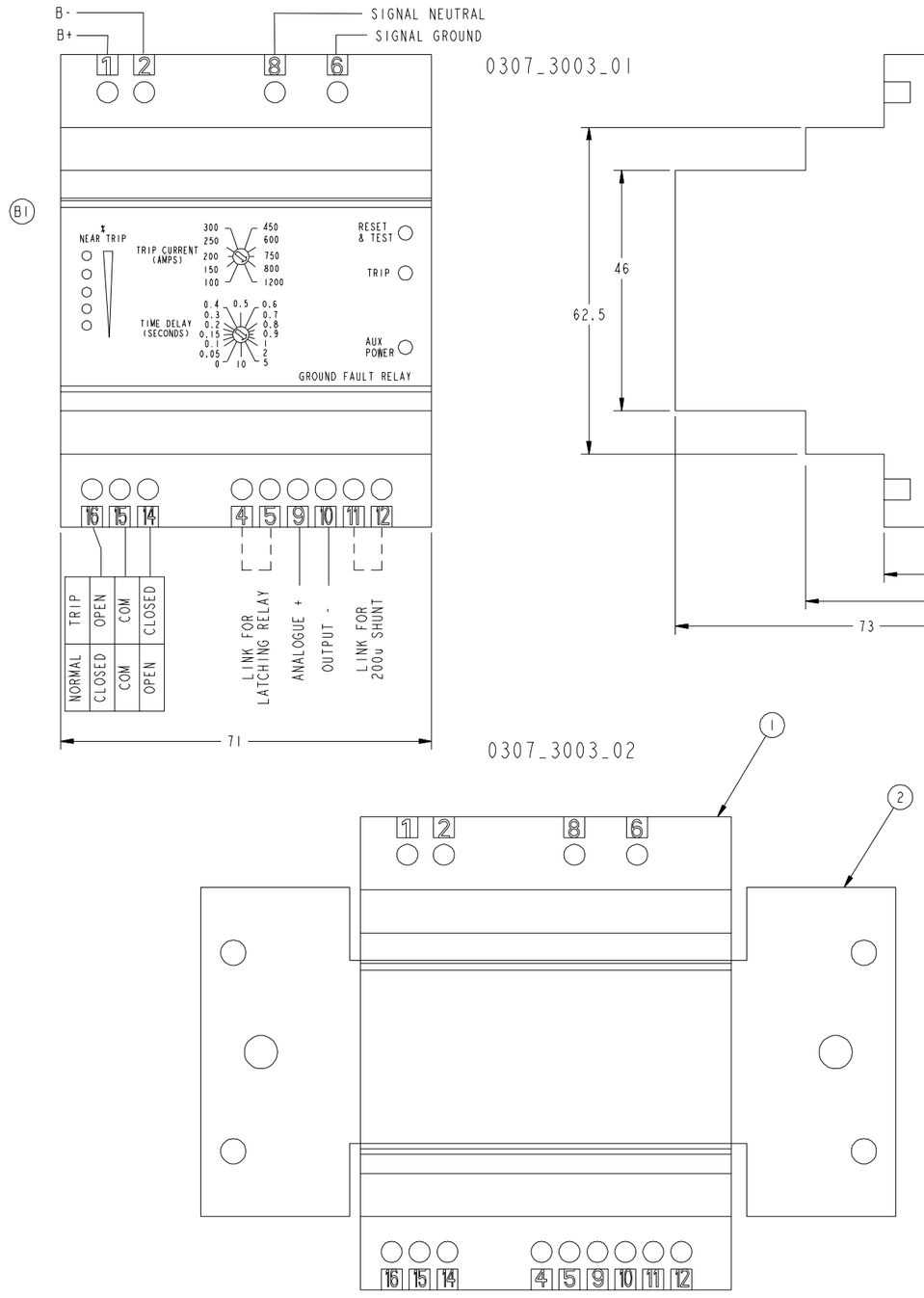
REV L

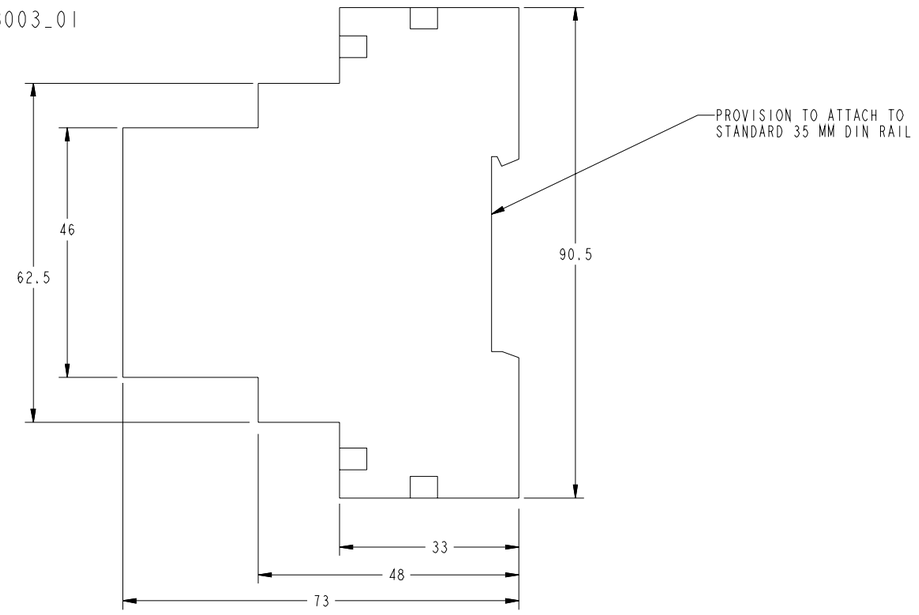
SHT 1 OF 1

HC6/HC7

0307_3003	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD15545	A	1	PRODUCTION_RELEASE	-	DAH	DDG	GILLETT	01-20-03
FRD17784	B	1	UPDATE SCHEMATIC	6D	DC	EK	EK	08-19-03
FRD17850	C	1	UPDATE SCHEMATIC	-	GWH	DDG	GILLETT	09-11-03





NOTES:

1. PART 0307_3003_01 IS VENDOR SOURCE CONTROLLED.

MAXIMUM AC TERMINAL VOLTAGE	600 VAC
SUPPLY VOLTAGE	12-48 VDC
CONTINUOUS CURRENT	5 AMPS
OPERATING AMBIENT TEMP	-10 TO +60 DEGREES C
WEIGHT	LESS THAN 250 GRAMS
TIME DELAY SETPOINT	ADJUSTABLE 0 TO 10 SECONDS
TIP CURRENT SETPOINT	100/150/200/250/300/450/600 /750/800/1200 AMPS
BURDEN	LESS THAN 1.5 WATTS
RESPONSE TIME	LESS THAN 200 MS
RATED CONTACT VOLTAGE	8 AMPS AT 250 VAC
RATED CONTACT VOLTAGE	8 AMPS AT 30 VDC

TABULATION	
PART NO.	CURRENT_ER
0307_3003_01	FRD17850
0307_3003_02	FRD17850

-THIS IS A CONTROLLED PRODUCT-
PER ONAN PROCEDURE FRE-1002
TO MAINTAIN COMPLIANCE WITH REQUIREMENTS OF THE CODES, STANDARDS, OR AGENCIES LISTED BELOW
☐ CSA ☒ UL ☐ EC ☐ NEMA ☐ ABYC
☐ OTHER _____ ☐ OTHER _____
AND/OR ASSIGN INTERNAL ONAN DESIGN CONTROL FACILITIES ☐
CHANGES, DEVIATIONS, OR SUBSTITUTIONS OF MATERIAL, PROCESS, OR PERFORMANCE FOR THIS PRODUCT MUST BE APPROVED BY THE FOLLOWING DESIGN CONTROL FACILITIES
DESIGN CONTROL FACILITY FRIDLEY
DESIGN CONTROL FACILITY _____

0307_3003_01 ONLY

QTY -02	QTY -01	ITEM	PART NO	ENG SYS	DESCRIPTION OR MATERIAL	REF DES
1	-	2	0319_5038_02	C	PLATE-MOUNTING (RELAY)	
1	-	1	0307_3003_01	D	RELAY-GROUND_FAULT	

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 2	.X ±
	.X ± 2	.XX ±
	.XX ± 0.38	.XXX±

HOLE		
	0.00-4.99 +0.15/-0.08	.004-.200 +.006/-.003
	5.00-9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-29.99 +0.30/-0.13	.704-.999 +.012/-.005

ANG TOL± 1.0 °

DRAWN TO SCALE OF 2/1

SIM TO .
COPIED FROM .
THIRD ANGLE PROJECTION

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	NAME	DATE
DR	D_HOFMEISTER	01-20-03
CHKR ☐ MFG ☐	D GILLETT	01-20-03
APPROVED	D GILLETT	01-20-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DQKC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: RELAY-GROUND_FAULT

DRG NO: 0307_3003

SHEET: 1 of 1

DRG SIZE: D

0625-3100 D

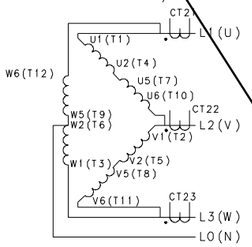
SC ,CC ,HC GENERATORS

3 PHASE RECONNECTABLE

VOLTAGE CONNECTION
CURRENT TRANSFORMER SECONDARY CONN 1-3

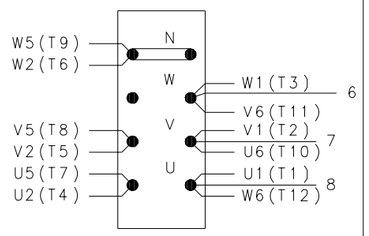
100/200V, 50HZ (R79)
110/220V, 50HZ (R028)
115/230V, 50HZ (R071)
120/240V, 60HZ (R106)

* RANGE *
100 - 120/200 - 240V

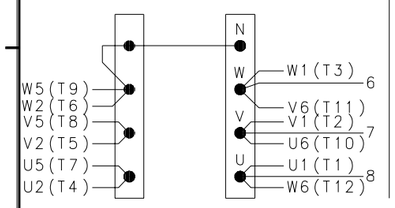


SERIES DELTA
3 PHASE 4 WIRE
OUTPUT TERMINALS
U.V.W.N.

FRAME 4

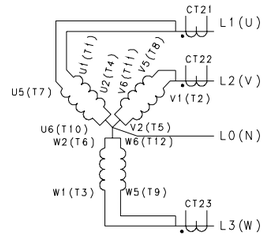


FRAME 5,6,& 7



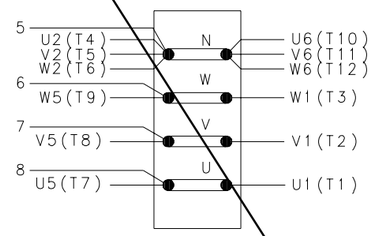
110/190V, 50HZ (R004)
120/208V, 50;60 HZ (R098)
127/220V, 50;60HZ (R020)
115/200V, 50HZ (R050)
133/230V, 50;60 HZ (R057)
139/240V, 60HZ (R067)
115/220V, 50HZ

* RANGE *
110 - 139/190 - 240V

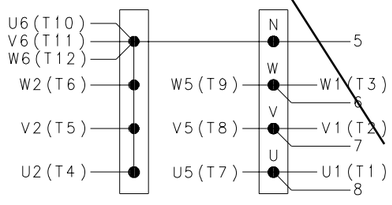


PARALLEL STAR
3 PHASE 4 WIRE
OUTPUT TERMINALS
U.V.W.N.

FRAME 4



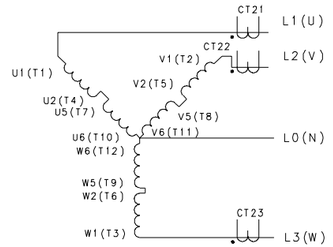
FRAME 5,6,& 7



VOLTAGE CONNECTION
CURRENT TRANSFORMER SECONDARY CONN 1-2

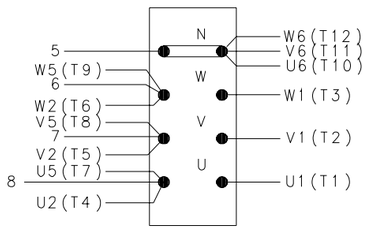
220/380V, 50;60 HZ (R099)
230/400V, 50 HZ (R029)
240/416V, 50 HZ (R003)
255/440V, 50;60 HZ (R023)
266/460V, 60 HZ (R027)
260/450V, 50;60 HZ (R109)
277/480V, 60 HZ (R002)
200/346V, 50 HZ (R068)

* RANGE *
220 - 277/380 - 480V

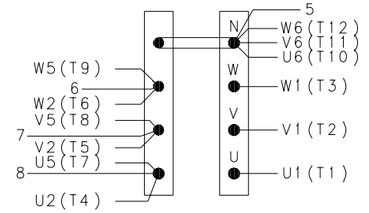


SERIES STAR
3 PHASE 4 WIRE
OUTPUT TERMINALS
U.V.W.N.

FRAME 4



FRAME 5,6,& 7



C1

ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
67947	A	1	PRODUCTION RELEASE	-	TAS	JC	ERICKSON	06-27-94
69782	B	1	ADDED NOTE 2	2B	CC	BG	ERICKSON	03-14-95
		2	SEE SHEET 2	--	CC	BG	ERICKSON	03-14-95
71002	C	1	U2(T4) WAS V2(T4)	4A	CC	BG	ERICKSON	09-25-95
71486	D	1	ADDED NOTE 3	2C	CC	BG	ERICKSON	11-10-95
72158	E	1	SEE SHEET 2	--	--	---	--------	--------
72380	F	1	REVISED PER ER	--	CC	BG	BAH	04-05-96
77162	G	1	REVISED PER ER	--	CC	BG	TAL	04-17-98

NOTES:

1. UVW PHASE SEQUENCE WITH C.W. ROTATION FACING DRIVE END.
2. (B1) TIE BACK UNUSED LEADS.
3. (D1) WHEN RECONNECTING GENERATOR LEADS, BOLTS SHOULD BE TORQUED AT 68 ±6 FT-LBS. FOR FRAMES 5, 6 AND 7.
4. WHEN RECONNECTING GENERATOR LEADS, BOLTS SHOULD BE TORQUED AT 22 ±2 FT-LBS. FOR FRAMES 4.
5. NEUTRAL FLOATED FOR DELTA CONFIGURATION. TIE LEAD 5 BACK INTO HARNESS.

PC CONTROL

REVISIO DWG

CLASSIFICATION OF CHARACTERISTICS
KEY INSTRUCTION (NO TOLERANCE)
CRITICAL
MAJOR
MINOR (NONE)
LINE BELOW SYMBOL APPLIES TO UPPER LIMIT
LINE ABOVE SYMBOL APPLIES TO LOWER LIMIT
NO LINE WITH SYMBOL APPLIES TO BOTH LIMITS
APPROVED P. ERICKSON
DATE 07-05-94

DO NOT SCALE PRINT
ANG TOL ±
DRAWN TO SCALE OF NONE

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	Inch
X	±	.X ±
.X	±	.XX ±
.XX	±	.XXX ±
HOLE	0.89- 4.99 +0.15/-0.08	.004-.200 +.006/-.003
	5.00- 9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 +0.30/-0.13	.704-.999 +.012/-.005

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SW # 0625-2165 D
COPIED FROM
THIRD ANGLE PROJECTION
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982
MODEL FIRST USED ON PCC

ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	REF REQ

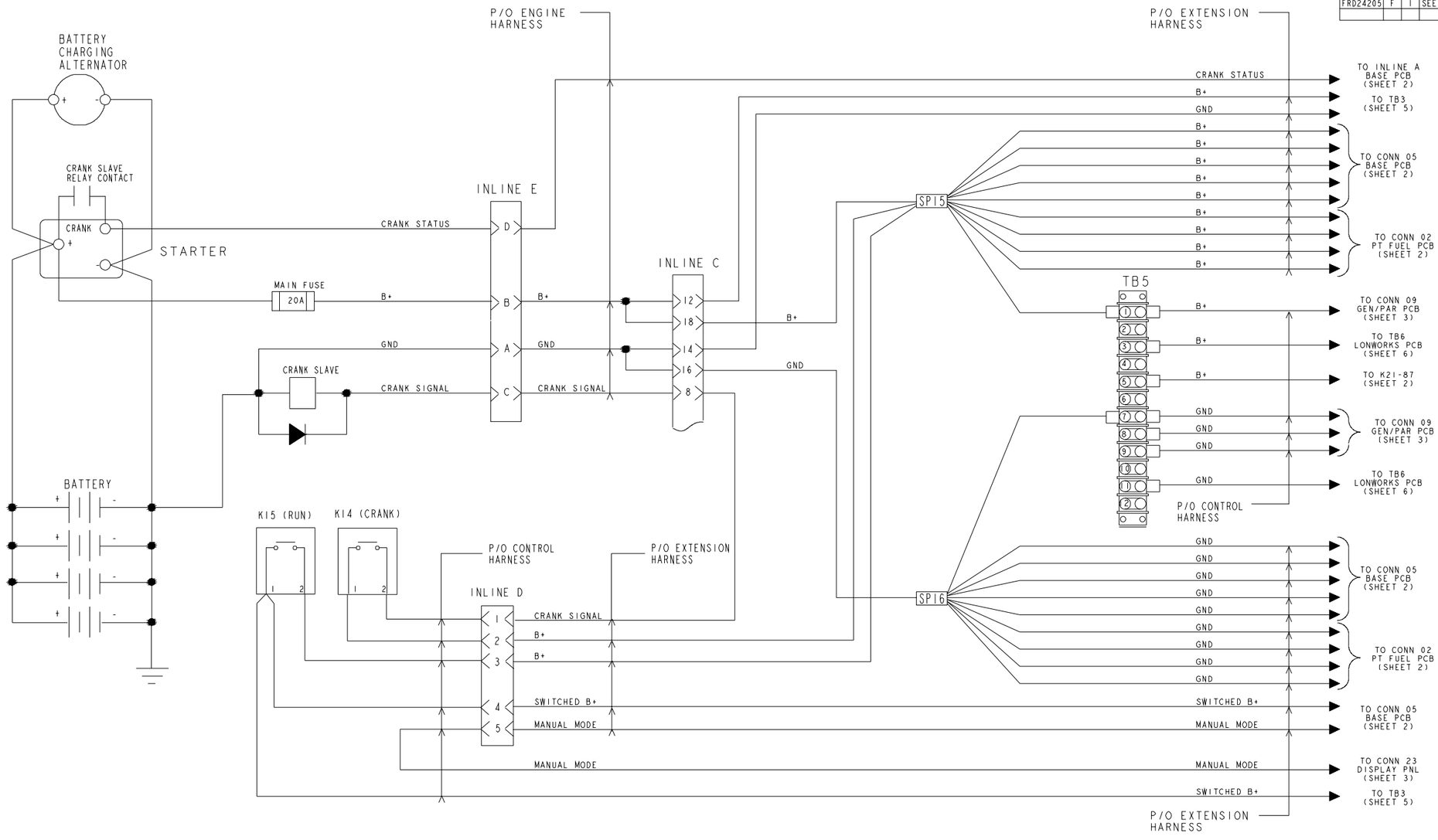
	NAME	DATE
DR	T.A. SORENSEN	06-27-94
CHKR MFG	T.A. SORENSEN	06-27-94
APPROVED	P. ERICKSON	06-27-94

Onan
MINNEAPOLIS, MINNESOTA 55432
TITLE WD-GEN RECONNECT
DWG NO. 0625-3100
SHEET 1 of 2
DWG SIZE D

0630_2592	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16192	A	1	PRODUCTION_RELEASE	-	GWH	RB	BOOSE	04-02-03
FRD16736	B	1	ADD SHEETS 8, 9 & 10	-	APE	BB	BB	05-16-03
FRD17850	C	1	SEE SHEET 6	--	GWH	RB	BOOSE	09-02-03
		2	SEE SHEET 6	--	GWH	RB	BOOSE	09-02-03
		3	SEE SHEET 6	--	GWH	RB	BOOSE	09-02-03
		4	SEE SHEET 6	--	GWH	RB	BOOSE	09-02-03
FRD18287	D	1	SEE SHEET 9	--	MJK	BBB	BBB	10-07-03
		2	SEE SHEET 10	--	MJK	BBB	BBB	10-07-03
		3	SEE SHEET 11	--	MJK	BBB	BBB	10-07-03
FRD18545	E	1	SEE SHEET 2	--	DAH	DGG	GILLETT	12-29-03
		2	SEE SHEET 7	--	DAH	DGG	GILLETT	12-29-03
FRD24205	F	1	SEE SHEET 4	--	GWH	BG	HEALY	07-26-05

DC POWER AND STARTER WIRING



Q15 GENSET WIRING DIAGRAM

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED: mm: X ± 1, .X ± 0.8, .XX ± 0.38; inch: .X ±, .XX ±, .XXX ±	SIM TO 0630_2572 D	ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES
ANG TOL ± 1.0	HOLE: 0.99-4.99 +0.15/-0.38 .004-.200 +.006/-.003; 5.00-9.99 +0.20/-0.10 .201-.421 +.008/-.004; 10.00-17.49 +0.25/-0.13 .422-.703 +.010/-.005; 17.50-24.99 +0.38/-0.13 .704-.999 +.012/-.005	COPIED FROM 0630_2572 D	NAME	DATE		CUMMINS POWER GENERATION 1400 73RD AVE NE MINNEAPOLIS, MINNESOTA 55432	
DRAWN TO SCALE OF 1/1		THIRD ANGLE PROJECTION	DR G_W_HUEBNER	04-02-03		TITLE: WD-INTERCONNECTION	
			CHKR MFG R BOOSE	04-02-03			
		This document is the property of Cummins Power Generation, it contains proprietary and confidential information which must not be duplicated, used or disclosed other than expressly authorized by Cummins Power Generation or it's representative	APPROVED R BOOSE	04-02-03	SITE CODE		
			FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982	MODEL FIRST USED ON: DFEG,EH,EJ,EK	PGA	DWG NO 0630_2592	SHEET 1 of 11 SIZE D

0630_2592	D	Pro/ENGINEER	METRIC DWG

ENGINE SENSORS

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16192	A	1	PRODUCTION_RELEASE	-	GWH	RB	BOOSE	04-02-03
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	--------------	--	---	---	-----	--------
FRD18287	D	--	--------------	--	---	---	-----	--------
FRD18545	E	1	SEE ER	--	DAH	DDG	GILLETT	12-29-03
FRD24205	F	--	--------------	--	---	---	-------	--------

P/O ENGINE HARNESS

P/O EXTENSION HARNESS

INLINE B

CONN 02

TP FUEL SYS PCB

ENGINE SPEED — SIGNAL, RETURN

AMBIENT AIR PRESSURE — SUPPLY, SIGNAL, RETURN

FUEL RAIL PRESSURE — SUPPLY, SIGNAL, RETURN

OIL PRESSURE TEMPERATURE — SUPPLY, PRESSURE SIGNAL, TEMPERATURE SIGNAL, RETURN

COOLANT LEVEL SWITCH — SUPPLY, RETURN, LOW, NORMAL

FUEL PRIMING PUMP RELAY — SIGNAL, RETURN

INLINE C

FUELING ACTUATOR (1) — SIGNAL, RETURN

TIMING RAIL ACTUATOR (1) — SIGNAL, RETURN

TIMING RAIL ACTUATOR (2) — SIGNAL, RETURN

FUELING ACTUATOR (2) — SIGNAL, RETURN

FUEL SHUTOFF — SIGNAL, RETURN

CENTINEL ACTUATOR — SUPPLY, RETURN

TO SPI5 (SHEET 1) — B+, B+, B+, B+

TO SPI6 (SHEET 1) — GND, GND, GND, GND

INLINE A

CONN 05

SPEED SENSOR — SUPPLY, SIGNAL, RETURN

COOLANT TEMP — SIGNAL, RETURN

CENTINEL OIL LEVEL SENSOR — SIGNAL, RETURN

CRANKSHAFT ENGINE POSITION SENSOR — SUPPLY, SIGNAL, RETURN

INTAKE MANIFOLD PRESSURE TEMPERATURE — SUPPLY, PRESSURE SIGNAL, TEMPERATURE SIGNAL, RETURN

RS232 DATA LINK — RS232-RI, RS232-DCD, RS232-TxD, RS232-RT's, RS232-DTR, RS232-CTS, RS232-RxD, RS232-DSR, RS232-GND

DIAGNOSTIC MODE ENABLE — SIGNAL, RETURN

TO BATT CHARGING ALT — FLASH STATUS

TO INLINE E — CRANK STATUS

P/O ENGINE HARNESS

P/O EXTENSION HARNESS

CONN 13

RS232 INPOWER DATALINK PORT

BASE PCB

CONN 06

RS485 DATA + — TO CONN 21 SWITCH PNL (SHEET 3)

RS485 DATA -

RESET SW/FFO ENABLE

LAMP TEST

LCL E-STOP - — TO CONN 23 DISPLAY PNL (SHEET 3)

LCL E-STOP +

BACKUP START DISCONNECT — K15 RUN RELAY COIL

BACKUP START DISCONNECT — K14 CRANK RELAY COIL — TO CONN 30 AVR MODULE (SHEET 4)

AVR DC POWER — CR1

RS485 TERM

P/O CONTROL HARNESS

CONN 05

B+, B+, B+, B+, B+ — TO SPI5 (SHEET 1)

GND, GND, GND, GND, GND — TO SPI6 (SHEET 1)

SWITCHED B+ MANUAL MODE — TO INLINE D (SHEET 1)

P/O EXTENSION HARNESS

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

ANG TOL ± 1.0°

DRAWN TO 1/1 SCALE OF

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 0.8	.XX ±
	.XX ± 0.38	.XXX±

MOLL			
0.00- 4.99	±0.15/-0.08	.004-.200	+.006/-.003
5.00- 9.99	±0.20/-0.10	.201-.421	+.008/-.004
10.00-17.49	±0.25/-0.13	.422-.703	+.010/-.005
17.50-24.99	±0.30/-0.13	.704-.999	+.012/-.005

SIM TO 0630_2572 D

COPIED FROM 0630_2572 D

THIRD ANGLE PROJECTION

	NAME	DATE
DR	G_W_HUEBNER	04-02-03
CHKR / MFG	R BOOSE	04-02-03
APPROVED	R BOOSE	04-02-03

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FOR INTERPRETATION OF DIMENSIONS AND TOLERANCES, USE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEG,EH,EJ,EK

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-INTERCONNECTION

DOC NO: 0630_2592

SHEET: 2 of 11

SIZE: D

0630_2592	D	Pro/ENGINEER	METRIC DWG

CONTROL WIRING

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16192	A	1	PRODUCTION_RELEASE	-	GWH	RB	BOOSE	04-02-03
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	--	----------	--	---	---	-----	--------
FRD18545	E	--	----------	--	---	---	-----	--------
FRD24205	F	--	----------	--	---	---	-------	--------

GENSET/PARALLEL PCB
0327-1376

CONN 07
- 1 UTILITY BREAKER TRIP 2 RELAY N/O CONTACT
- 2 FIRST START ENABLE SWITCH
- 3 LOAD DEMAND SHUTDOWN SWITCH
- 11 COMMON WARNING RELAY DRIVER
- 5 RAMP LOAD/UNLOAD SWITCH
- 6 SINGLE MODE ENABLE SWITCH
- 7 EXTERNAL KW +
- 8 EXTERNAL KW -
- 12 EXTERNAL KVAR +
- 10 EXTERNAL KVAR -
- 4 SYNC ENABLE SWITCH
- 9 UTILITY BREAKER TRIP 1 RELAY N/O CONTACT
- 13 CUSTOMER #4 SWITCH INPUT
- 14 GROUND FAULT METER INPUT
- 15 GROUND FAULT METER RETURN
- 16 GROUND FAULT SWITCH INPUT
- 17 GROUND FAULT SWITCH RETURN
- 18 CUSTOMER SWITCH RETURN
- 19 CUSTOMER #3 SWITCH INPUT

TO TB3 CUSTOMER CONNECTIONS (SHEET 5/6)

CONN 08
- 1 LOAD SHARE KVAR RETURN
- 2 LOAD SHARE KVAR INPUT
- 3 LOAD SHARE KW RETURN
- 11 LOAD SHARE KW INPUT
- 12 UTILITY BREAKER CLOSE 1 RELAY N/O CONTACT
- 6 UTILITY BREAKER CLOSE 2 RELAY N/O CONTACT
- 7 GENSET BREAKER CLOSE 1 RELAY N/O CONTACT
- 8 GENSET BREAKER CLOSE 2 RELAY N/O CONTACT
- 15 AUTO MODE OUTPUT
- 16 GENSET BREAKER TRIP 2 RELAY N/C CONTACT
- 4 GENSET BREAKER TRIP 1 RELAY N/C CONTACT
- 5 MODEM RELAY DRIVER OUTPUT
- 13 REMOTE LOW FUEL SWITCH INPUT
- 14 GENSET BREAKER POSITION SWITCH INPUT
- 9 GENSET BREAKER INHIBIT SWITCH INPUT
- 10 GENSET BREAKER SWITCH RETURN
- 17 UTILITY BREAKER POSITION SWITCH INPUT
- 18 UTILITY BREAKER INHIBIT SWITCH INPUT
- 19 UTILITY BREAKER SWITCH RETURN
- 20 DELAY OFF SWITCHED B+ — 30 K20 87
- B+
- 85 K20 86 TIME DELAY FUEL SHUTOFF RELAY DRIVER
- 23

TO TB3 CUSTOMER CONNECTIONS (SHEET 5/6)

CONN 09
- 7 LOCAL LOW FUEL SWITCH INPUT
- 43 LOCAL LOW FUEL SWITCH RETURN
- 17 CUSTOMER #1 SWITCH INPUT
- 6 CUSTOMER #2 SWITCH INPUT
- 13 CUSTOMER SWITCH RETURN
- 12 SHUTDOWN RELAY DRIVER
- 16 LOAD DUMP RELAY DRIVER
- 46 READY TO LOAD RELAY DRIVER
- 18 RELAY COIL SOURCE

TO TB3 CUSTOMER CONNECTIONS (SHEET 5/6)

ALL WIRING PART OF CONTROL HARNESS EXCEPT AS SPECIFIED

CONN 09
- 22 GENSET PHASE 1 CT INPUT
- 23 GENSET PHASE 1 CT COMMON
- 14 GENSET PHASE 2 CT INPUT
- 15 GENSET PHASE 2 CT COMMON
- 5 GENSET PHASE 3 CT INPUT
- 4 GENSET PHASE 3 CT COMMON
- 25 GENSET PHASE 1 PT INPUT
- 24 GENSET PHASE 1 PT COMMON
- 31 GENSET PHASE 2 PT INPUT
- 32 GENSET PHASE 2 PT COMMON
- 41 GENSET PHASE 3 PT INPUT
- 40 GENSET PHASE 3 PT COMMON

CONN 31
15 14 22 23 8 7 6 5 4 3 2 1

PT/CT MODULE
300-4308

CONN 33
- 9 CT PHASE 1 INPUT
- 8 CT PHASE 1 COMMON
- 11 CT PHASE 2 INPUT
- 10 CT PHASE 2 COMMON
- 7 CT PHASE 3 INPUT
- 6 CT PHASE 3 COMMON
- 4 GEN VOLTAGE PHASE 1
- 3 GEN VOLTAGE PHASE 2
- 2 GEN VOLTAGE PHASE 3
- 1 GEN VOLTAGE NEUTRAL

P/O AC HARNESS

GENERATOR/BUS CONNECTIONS (SHEET 4)

- 37 BUS/UTILITY PHASE 3 PT INPUT
- 36 BUS/UTILITY PHASE 3 PT COMMON
- 39 BUS/UTILITY PHASE 2 PT INPUT
- 38 BUS/UTILITY PHASE 2 PT COMMON
- 21 BUS/UTILITY PHASE 1 PT INPUT
- 20 BUS/UTILITY PHASE 1 PT COMMON

BUS-TB2
2 1 4 3 6 5

CONN 15
8 15 23 / 1 9 16

BUS-TB1
N C B A
- BUS VOLTAGE NEUTRAL
- BUS VOLTAGE PHASE 3
- BUS VOLTAGE PHASE 2
- BUS VOLTAGE PHASE 1

CUSTOMER WIRING

BUS-TB3
1 2 3 4
- TO NEXT MODULE: INHIBIT, INHIBIT GND
- FROM PREVIOUS MODULE: INHIBIT, INHIBIT GND

CUSTOMER WIRING

BUS-TB4
1 2 3 4
- GND
- B+
- FIRST START ENABLE SWITCH
- READY TO LOAD RELAY DRIVER

TO TB3 CUSTOMER CONNECTIONS (SHEET 5)

BUS PT MODULE
300-4309

CONN 23
- 42 AUTO MODE ACKNOWLEDGE
- 8 REMOTE START LED
- 19 DIGITAL DISPLAY RETURN
- 49 USER I.F. COMMON SHUTDOWN LED OUTPUT
- 33 USER I.F. COMMON WARNING LED OUTPUT
- 44 RUN SWITCH INPUT/EXERCISE LED DVR OUTPUT
- 9 EXERCISE SWITCH INPUT/RUN LED DVR OUTPUT
- 26 AUTO SWITCH INPUT

21 17 11 16 20 22 12 3

POWER COMMAND

DISPLAY PNL
300-5312

SWITCH PNL
300-5211

CONN 23
- 13 PANEL LAMP B+ DRIVE
- 8 PANEL LAMP GND
- 18 MANUAL MODE → TO INLINE D (SHEET 1)
- 9 RESET SW/FFO ENABLE
- 1 LAMP TEST
- 15 LCL E-STOP -
- 23 LCL E-STOP +

TO CONN 06 BASE PCB (SHEET 2)

CONN 21
- 1 RS485 DATA +
- 2 RS485 DATA -

CONN 21
- 28 USER INTERFACE SWITCHES RETURN
- 27 DIGITAL DISPLAY WAKE-UP INPUT
- 45 USER INTERFACE POWER CONTROL OUTPUT

5 12 11

CONN 12
- 8 RXD
- 7 TXD
- 9 WAKEUP
- 6 GND
- 10

2 3 6 5

RS232 DISPLAY PANEL PROGRAM PORT

- 11 UTILITY CT INPUT
- 10 UTILITY CT RETURN → TO TB3 (SHEET 5)
- 29 AVR CONTROL + OUTPUT
- 30 AVR CONTROL - OUTPUT → TO AVR (SHEET 4)
- 50 BATTERY + INPUT
- 47 BATTERY - INPUT
- 48 BATTERY - INPUT
- 2 BATTERY - INPUT → TO TB5 (SHEET 1)

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 0.8	.XX ±
	.XX ± 0.38	.XXX ±
HOLE	0.00-4.99 +0.15/-0.00	.004-.200 +.006/-.002
	5.00-9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 +0.30/-0.13	.704-.999 +.012/-.005

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SIM TO 0630_2572 D

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THIRD ANGLE PROJECTION

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CHKR / MFG	R BOOSE	04-02-03
APPROVED	R BOOSE	04-02-03

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MODEL FIRST USED ON: DFEG,EH,EJ,EK

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

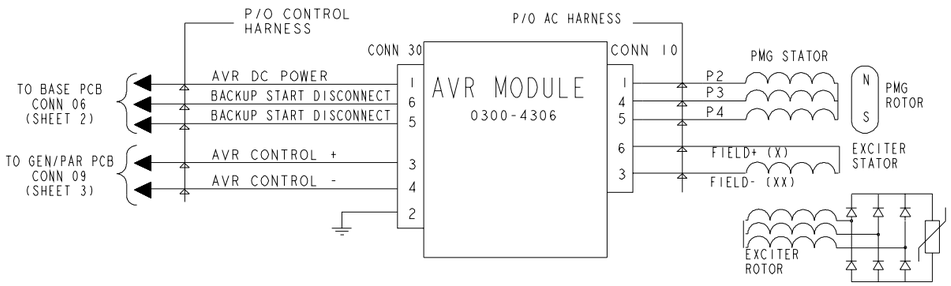
TITLE: WD-INTERCONNECTION

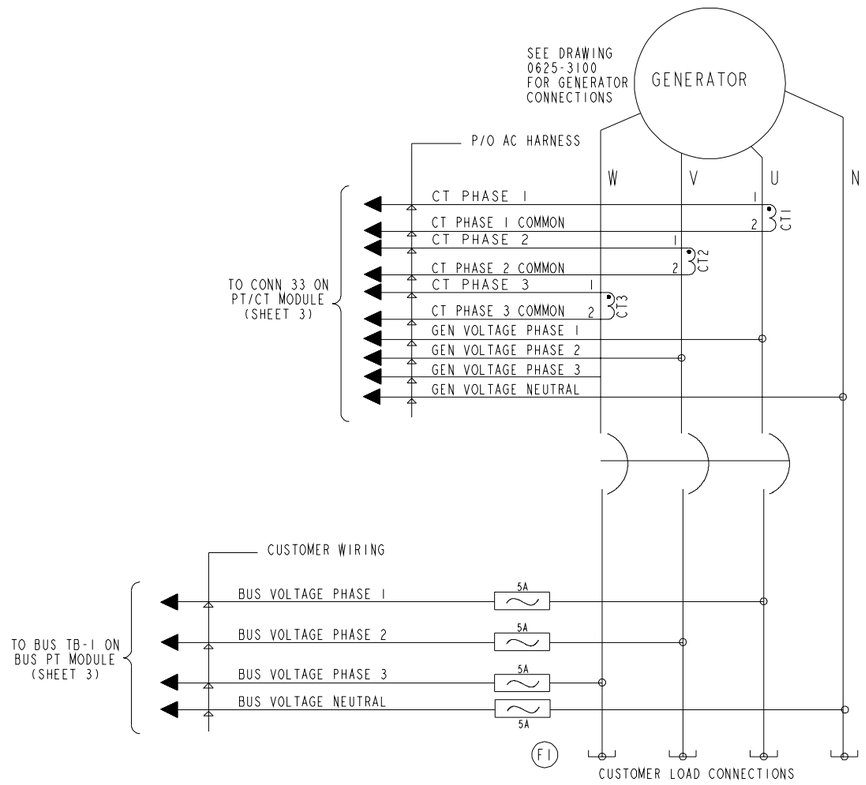
DRG NO 0630_2592 | SHEET 3 of 11 | DRG SIZE D

0630_2592	D	Pro/ENGINEER	METRIC DWG

GENERATOR/BUS CONNECTIONS

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16192	A	1	PRODUCTION_RELEASE	-	GWH	RB	BOOSE	04-02-03
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	--	----------	--	---	---	-----	--------
FRD18545	E	--	----------	--	---	---	-----	--------
FRD24205	F	1	ADD 5 AMP FUSE TO BUSS VOLTAGE LEAD	4A	GWH	BG	HEALY	07-26-05





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	mm	inch	
DIM	X ± 1 .X ± 0.8 .XX ± 0.38	.X ± .XX ± .XXX±	
HOLE	0.99- 4.99 +0.15/-0.08 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005	

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ITEM	PART NO	ENG SIZE	DESCRIPTION OR MATERIAL	REF DES

SIM TO 0630_2572	D	NAME		DATE
COPIED FROM 0630_2572	D	DR	G_W_HUEBNER	04-02-03
THIRD ANGLE PROJECTION		CHKR / MFG	R BOOSE	04-02-03
		APPROVED	R BOOSE	04-02-03
FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982		MODEL FIRST USED ON	DFEG,EH,EJ,EK	

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-INTERCONNECTION

DRG NO: 0630_2592 | SHEET: 4 of 11 | ENG SIZE: D

0630_2592	D	Pro/ENGINEER	METRIC DWG

CUSTOMER CONNECTIONS

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
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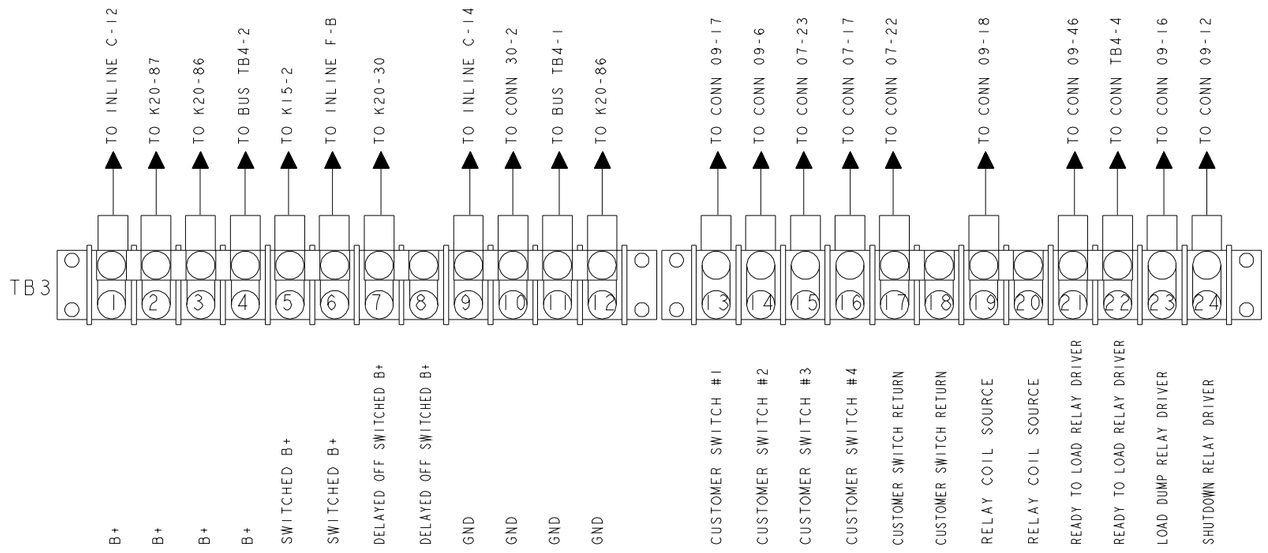
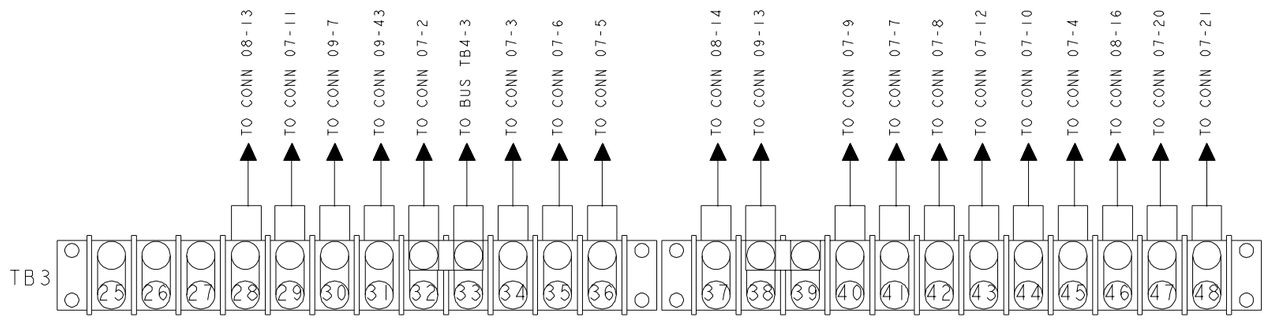
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	--	----------	--	---	---	-----	--------
FRD18545	E	--	----------	--	---	---	-----	--------
FRD24205	F	--	----------	--	---	---	-------	--------





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	mm	inch
DIM	X ± 1 .X ± 0.8 .XX ± 0.38	.X ± .XX ± .XXX ±
WHOLE	0.00-4.99 ±0.15/-0.08 5.00-9.99 ±0.20/-0.10 10.00-17.49 ±0.25/-0.13 17.50-24.99 ±0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005

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THIRD ANGLE PROJECTION

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1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE WD-INTERCONNECTION

DRG NO 0630_2592

SHEET 5 of 11

DRG SIZE D

0630_2592	D	Pro/ENGINEER	METRIC DWG

CUSTOMER CONNECTIONS

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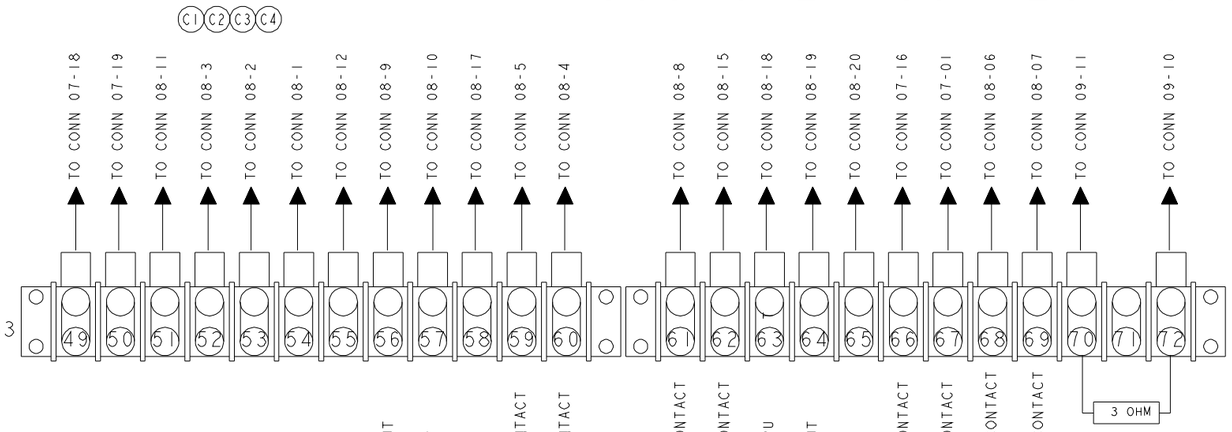
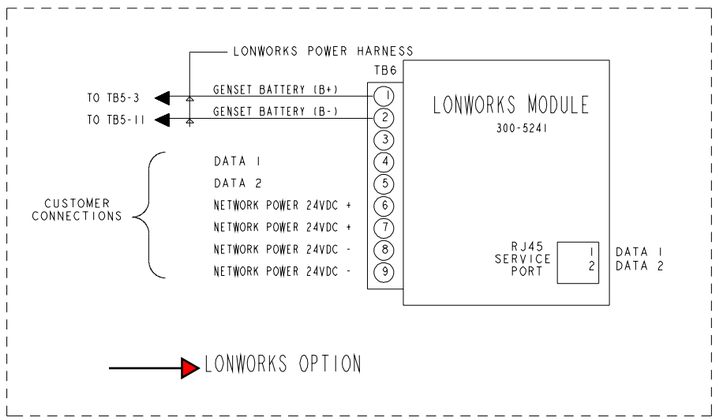
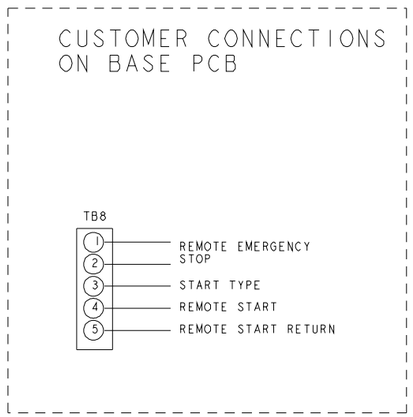
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	1	TO CONN 08-11 WAS 08-1	6D	GWH	RB	BOOSE	09-02-03
		2	TO CONN 08-3 WAS 08-2	6D	GWH	RB	BOOSE	09-02-03
		3	TO CONN 08-2 WAS 08-3	6D	GWH	RB	BOOSE	09-02-03
		4	TO CONN 08-1 WAS 08-11	6D	GWH	RB	BOOSE	09-02-03
FRD18287	D	-	-	-	-	-	-	-
FRD18545	E	--	-------	--	---	---	------	---------
FRD24205	F	--		--	---	---	--------	---------



TABULATION		
TB8-	FUNCTION	DESCRIPTION
1 2	REMOTE EMERGENCY STOP	OPEN THE CONNECTION BETWEEN THESE TERMINAL POSITIONS TO INITIATE AN EMERGENCY STOP. TERMINAL POSITIONS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP IS NOT USED.
3	REMOTE START TYPE	DETERMINES START TYPE: OPEN = EMERGENCY START SEQUENCE. CLOSED = NORMAL START SEQUENCE. APPLY REMOTE START RETURN (TB8-5) TO CLOSE.
4	REMOTE START	APPLY REMOTE START RETURN (TB8-5) TO REMOTE START THE GENSET.
5	REMOTE START RETURN	RETURN LINE FOR REMOTE START TYPE AND REMOTE START.





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THIRD ANGLE PROJECTION

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SHEET: 6 of 11

DRG SIZE: D

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FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	--	----------	--	---	---	-----	--------
FRD18545	E	2	SEE ER	--	DAH	DDG	GILLETT	12-29-03
FRD24205	F	--	----------	--	---	---	-------	--------

TABULATION

TB3-	FUNCTION	DESCRIPTION
1-4	B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY
5-6	SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY, AVAILABLE WHEN GENSET IS RUNNING
7-8	DELAYED OFF SWITCHED B+	24VDC/10 AMPS BATTERY VOLTAGE SUPPLY, AVAILABLE WHEN GENSET IS RUNNING. CONFIGURABLE DELAYED OFF IS TYPICALLY USED FOR FUEL SHUTOFF
9-12	GND	BATTERY NEGATIVE
13	CONFIGURABLE INPUT #1	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
14	CONFIGURABLE INPUT #2	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
15	CONFIGURABLE INPUT #3	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
16	CONFIGURABLE INPUT #4	CONFIGURABLE INPUT USED TO INITIATE A WARNING OR SHUTDOWN CONDITION. APPLY WITH (TB3-17/18) TO ACTIVATE
17	CONFIGURABLE INPUT RETURN	RETURN PATH FOR CONFIGURABLE INPUTS. (TB3-13,14,15,16)
19	RELAY COIL SOURCE	SWITCHED 24VDC POWER SUPPLY. USE ON THE HIGH SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY DRIVER. PROVIDES A MINIMUM 800ma OF CURRENT
21-22	READY TO LOAD RELAY DRIVER	ACTIVATES WHEN GENSET HAS REACHED 90% OF FREQUENCY. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
23	LOAD DUMP RELAY DRIVER	ACTIVATES AT A CONFIGURABLE LOAD LEVEL OR UNDER FREQUNCY CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
24	COMMON SHUTDOWN RELAY DRIVER	ACTIVATES ON ANY GENSET SHUTDOWN CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
25	SPARE	
26	SPARE	
27	SPARE	
28	MODEM RELAY DRIVER	PROVIDES A CONFIGURABLE METHOD OF CONTROLLING AND CYCLING POWER TO AN EXTERNAL MODEM. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH RELAY COIL SOURCE (TB3-19/20)
29	COMMON WARNING RELAY DRIVER	ACTIVATES ON ANY WARNING CONDITION. USE ON THE LOW SIDE OF THE CUSTOMER SUPPLIED RELAY COIL IN CONJUNCTION WITH A RELAY COIL SOURCE (TB3-19/20)
30	LOCAL LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS SUPPLIED WITH A DAY TANK OR AN INTEGRATED FUEL TANK. SWITCH RETURN WITH TB3-31
31	LOCAL LOW FUEL RETURN	SWITCH RETURN FOR LOCAL LOW FUEL INPUT (TB3-30)
32-33	FIRST START INPUT	FOR PARALLELLING APPLICATIONS, CONNECTS TO REMOTE MASTER START SENSOR OR BUS PT)MODULE WITH FIRST START SENSOR
34	LOAD DEMAND INPUT	FOR MULTIPLE GENSET PARALLEL APPLICATIONS. INPUT ALLOWS GENSET TO RAMP TO NO LOAD, OPEN BREAKER AND SHUT DOWN. REMOVING INPUT CAUSES GENSET TO START, SYNCHRONIZE, CLOSE BREAKER, AND RAMP TO LOAD. APPLY WITH SWITCH RETURN (TB3-38/39)
35	SINGLE MODE ENABLE INPUT	FOR SINGLE GENSET PARALLEL POWER TRANSFER (PLT) APPLICATIONS ONLY. APPLY WITH SWITCH RETURN (TB3-38/39) TO ENABLE MODE
36	RAMP LOAD/UNLOAD SWITCH	USED WITH MULTIPLE GENSETS IN PARALLEL IN CONJUNCTION WITH A MASTER CONTROL OR OTHER PLC DEVICE. APPLY SWITCH RETURN (TB3-38/39) TO LOAD/UNLOAD GENSET AS LOAD PROFILE DICTATES
37	REMOTE LOW FUEL INPUT	PROVIDES A LOW FUEL INDICATION FOR GENSETS THAT ARE NOT FITTED WITH AN INTEGRATED FUEL TANK. APPLY SWITCH RETURN TB3-38/39 TO ACTIVATE
38-39	SWITCH RETURN	SWITCH RETURN FOR TB3-34, 35, 36, AND 37
40	SYNC ENABLE INPUT	FOR USE IN SINGLE MODE PLT APPLICATIONS ONLY. INPUT SIGNALS GENSET TO SYNCHRONIZE WITH UTILITY
41	LOAD GOVERN KW+ INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KW LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC
42	LOAD GOVERN KW-	RETURN LINE LOAD GOVERN KW
43	LOAD GOVERN KVAR+ INPUT	ALLOWS A REMOTE DEVICE TO CONTROL KVAR LOAD ON GENSET WHILE UTILITY PARALLELED. ANALOG INPUT 0-5VDC. THIS INPUT IS DEFAULTED TO "DISABLED" AND IS ENABLED WITH INPOWER
44	LOAD GOVERN KVAR-	RETURN LINE LOAD GOVERN KVAR

TABULATION

TB3-	FUNCTION	DESCRIPTION
45	EXTERNAL KW/KVAR SHIELD	SHIELD TERMINATION POINT FOR LOAD GOVERN INPUTS
46	AUTO MODE OUTPUT	SWITCH BATTERY 24VDC, FUSED AT 5A. AVAILABLE WHEN GENSET IS IN AUTO MODE
47	GROUND FAULT INPUT	ACTIVATES A GROUND FAULT WARNING WHEN SWITCHED TO THE GROUND FAULT RETURN (TB3-48). USE IN CONJUNCTION WITH AN EXTERNAL GROUND FAULT RELAY
48	GROUND FAULT RETURN	RETURN LINE FOR GROUND FAULT INPUT
49	GROUND FAULT ANALOG INPUT	FUTURE FEATURE
50	GROUND FAULT METER RETURN	RETURN LINE FOR GROUND FAULT ANALOG INPUT
51	LOAD SHARE KW+	FOR ISOLATED BUS PARALLELING ONLY. KW LOAD SHARING LINES FOR POWER COMMAND GENSETS
52	LOAD SHARE KW-	RETURN FOR LOAD SHARE KW
53	LOAD SHARE KVAR+	FOR ISOLATED BUS PARALLELING ONLY. KVAR LOAD SHARING LINES FOR POWER COMMAND GENSETS
54	LOAD SHARE KVAR+	RETURN FOR LOAD SHARE KVAR
55	LOAD SHARE SHIELD	SHIELD TERMINATION POINT FOR LOAD SHARE KW AND LOAD SHARE KVAR LINES
56	GENSET BREAKER POSITION SWITCH INPUT	FOR PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT GENSET BREAKER IS CLOSED. USE WITH GENSET BREAKER SWITCH RETURN (TB3-58)
57	GENSET BREAKER INHIBIT SWITCH INPUT	FOR PARALLELING APPLICATIONS. WHEN CLOSED TO GENSET BREAKER SWITCH RETURN (TB3-50), GENSET BREAKER WILL OPEN, OR BE PREVENTED FROM CLOSING
58	GENSET BREAKER SWITCH RETURN	RETURN LINE FOR TB3-56/57
59	GENSET BREAKER OPEN COMMAND	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY CLOSED CONTACT THAT OPENS TO OPEN GENSET BREAKER. USE WITH TB3-60
60	GENSET BREAKER OPEN COMMAND RETURN	USE WITH TB3-59
61	GENSET BREAKER CLOSE COMMAND	FOR USE IN PARALLELING AND POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSES TO CLOSE GENSET BREAKER. USE WITH TB3-62
62	GENSET BREAKER CLOSE COMMAND RETURN	USE WITH TB3-61
63	UTILITY BREAKER POSITION INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED INDICATES TO CONTROL THAT UTILITY BREAKER IS CLOSED. USE WITH UTILITY BREAKER RETURN (TB3-65)
64	UTILITY BREAKER INHIBIT INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. WHEN CLOSED TO UTILITY BREAKER RETURN (TB3-65), UTILITY BREAKER WILL OPEN, OR BE PREVENTED FROM CLOSING
65	UTILITY BREAKER RETURN	USE WITH TB3-63/64
66	UTILITY BREAKER OPEN COMMAND	FOR POWER TRANSFER CONTROL APPLICATIONS. NORMALLY CLOSED CONTACT THAT OPENS TO OPEN UTILITY BREAKER. USE WITH TB3-67
67	UTILITY BREAKER OPEN COMMAND RETURN	USE WITH TB3-66
68	UTILITY BREAKER CLOSE COMMAND	FOR POWER TRANSFER CONTROL APPLICATIONS. NORMALLY OPEN CONTACT THAT CLOSES TO CLOSE UTILITY BREAKER. USE WITH TB3-69
69	UTILITY BREAKER CLOSE COMMAND RETURN	USE WITH TB3-68
70	SYSTEM LOAD INPUT	FOR POWER TRANSFER CONTROL APPLICATIONS. ACCEPTS CT INPUT FOR MONITORING B PHASE CURRENT ON THE UTILITY BUS. USE UTILITY CT RETURN (TB3-72). A 3 OHM BURDEN RESISTOR IS CONNECTED ACROSS TB3-70 AND TB3-72
71	SPARE	
72	SYSTEM LOAD RETURN	USE WITH TB3-70

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1 .X ± 0.8 .XX ± 0.38	.X ± .XX ± .XXX±
HOLE	0.99- 4.99 +0.15/-0.38 5.00- 9.99 +0.20/-0.10 10.00-17.49 +0.25/-0.13 17.50-24.99 +0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.703 +.010/-.005 .704-.999 +.012/-.005

ANG TOL± 1.0 °

DRAWN TO SCALE OF 1/1

Sim to 0630_2572 D

COPIED FROM 0630_2572 D

THIRD ANGLE PROJECTION

	NAME	DATE
DR	G_W_HUEBNER	04-02-03
CHKR ID MFG	R BOOSE	04-02-03
APPROVED	R BOOSE	04-02-03

SITE CODE: PGA

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: DFEG,EH,EJ,EK

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-INTERCONNECTION

DRG NO: 0630_2592

SHEET: 7 of 11

DWG SIZE: D

0630_2592	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	--	----------	--	---	---	-----	--------
FRD18545	E	--	----------	--	---	---	-----	--------
FRD24205	F	--	----------	--	---	---	--------	--------

CUSTOMER CONNECTIONS TERMINAL STRIP

TB3

B+ (20A FUSED)

SWITCHED B+

GROUND

TB3-1 HIGH FUEL ALARM HORN (SEE SHEET 9)

TB3-9

TB3-5 LOUVER RELAY (SEE SHEET 9)

TB3-10

RUPTURE BASIN — TB3-13 LEAK BASIN SWITCH (CUST. SWI)

TB3-18 OR TRAMONT 2000 CONTOLLER (SEE SHEET 9) (CLOSES ON LEAK)

TB3

LOW FUEL — TB3-30 LOW FUEL SWITCH (SEE SHEET 9) (CLOSES ON LOW FUEL)

TB3-31

TB10

120VAC POWER CORD PLUG INTO J3 (SEE SHEET 11)

GND

CONTROL CABINET HEATER

120VAC POWER CORD PLUGS INTO J3 (SEE SHEET 11)

EMERGENCY STOP BUTTON (SEE SHEET 9)

N.C.

N.O.

COM

NOTE: WIRE N.O. NOT CONNECTED

TB8

1	1
2	2
3	3
4	4
5	5

N.O.

N.C.

COM

REMOVE JUMPER TB8-1 TO TB8-2 WHEN INSTALLING EMERGENCY STOP BUTTON

OPTIONAL GENSET HEATERS AND AC DISTRIBUTION PANEL LOCATIONS

CONTROL CABINET HEATER
A362 (REAR SIDE)
120V, 150WATTS
CONNECTIONS: CORD [6FT] W/5-15PLUG

ALTERNATOR HEATER
A292
120V, 300WATTS
CONNECTIONS: CORD [6FT] W/5-15PLUG

AC DISTRIBUTION PANEL
NOTE: HEATER CORD SETS ARE RUN TO THIS LOCATION WITH OR WITOUT AC DISTRIBUTION PANEL BEING ORDERED

BATTERY HEATERS
(2) 333-0469
120V, 200WATTS
(1 FOR EACH BATTERY)
CONNECTIONS: CORD [6FT] W/5-15PLUG

ENGINE OIL HEATER
H487
120V, 450WATTS
CONNECTIONS: CORD [6FT] W/5-15PLUG

COOLANT HEATER
(H555 H557)
208V, 3744WATTS - H556
208V, 4825WATTS - H557
240V, 4990WATTS - H556
240V, 6420WATTS - H557
NOTE: FOR COOLANT HEATER MOUNTING SEE OUTLINE DRAWING 500-3312

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

ANG TOL ± 1.0°

DRAWN TO 1/1 SCALE OF

TOLERANCE UNLESS OTHERWISE SPECIFIED			
	mm		inch
DIM	X ± 1		.X ±
	.X ± 0.8		.XX ±
	.XX ± 0.38		.XXX ±
HOLE	0.99- 4.99	+0.15/-0.08	.004-.200 +.006/-.003
	5.00- 9.99	+0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49	+0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99	+0.30/-0.13	.704-.999 +.012/-.005

SIM TO 0630_2572 D

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THIRD ANGLE PROJECTION

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	NAME	DATE
DR	G.W.HUEBNER	04-02-03
CHKR / MFG	R BOOSE	04-02-03
APPROVED	R BOOSE	04-02-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON DFEG,EH,EJ,EK

SITE CODE PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE WD-INTERCONNECTION .

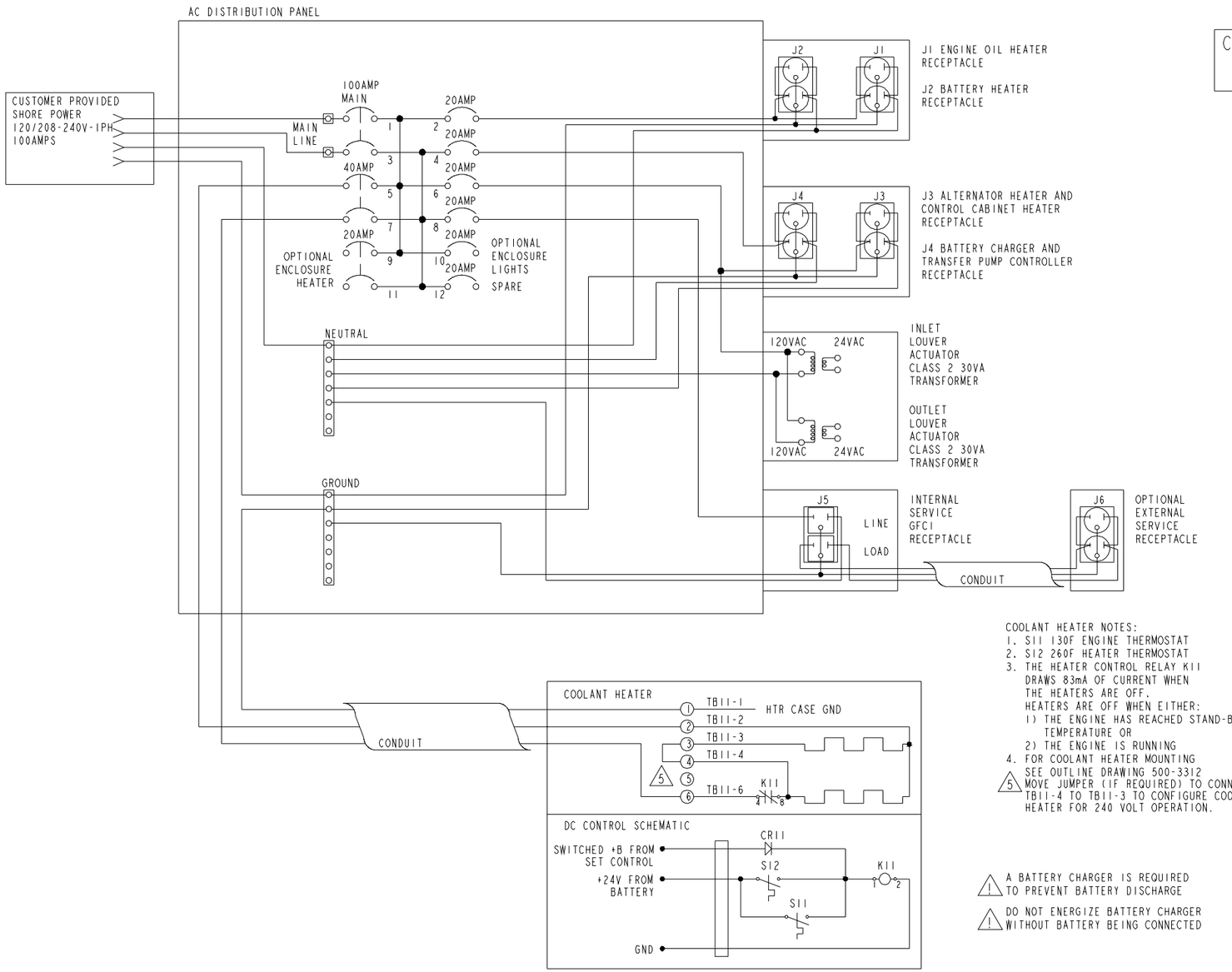
DWG NO 0630_2592

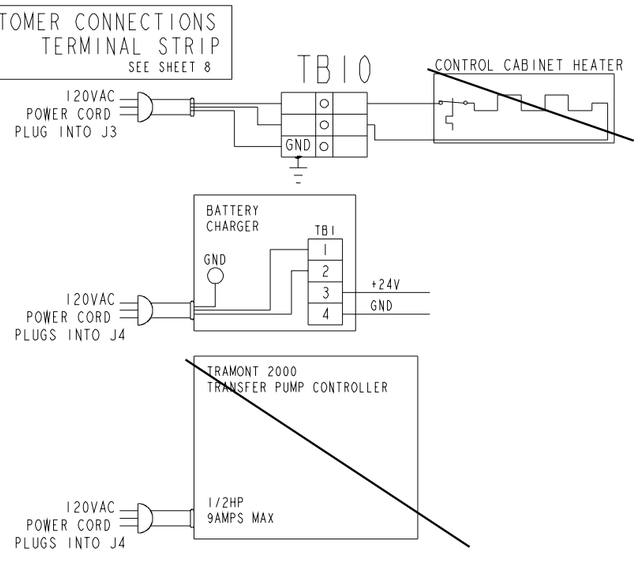
SHEET 8 of 11

DWG SIZE D

0630_2592	D	Pro/ENGINEER	METRIC DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD16736	B	-	-	-	-	-	-	-
FRD17850	C	--	----------	--	---	---	-----	--------
FRD18287	D	3	WAS SHEET 10 AND ADDED NOTE 5	-	MJK	BBB	BBB	10-07-03
FRD18545	E	--	----------	--	---	---	-----	--------
FRD24205	F	--	----------	--	---	---	--------	--------





COOLANT HEATER NOTES:
1. SII 130F ENGINE THERMOSTAT
2. SI2 260F HEATER THERMOSTAT
3. THE HEATER CONTROL RELAY KII DRAWS 83mA OF CURRENT WHEN THE HEATERS ARE OFF.
   HEATERS ARE OFF WHEN EITHER:
   1) THE ENGINE HAS REACHED STAND-BY TEMPERATURE OR
   2) THE ENGINE IS RUNNING
4. FOR COOLANT HEATER MOUNTING SEE OUTLINE DRAWING 500-3312
5. MOVE JUMPER (IF REQUIRED) TO CONNECT TBII-4 TO TBII-3 TO CONFIGURE COOLANT HEATER FOR 240 VOLT OPERATION.

COOLANT HEATER AMPERAGE TABLE				
SINGLE PHASE HEATER VOLTAGE	FEATURE CODE H556 ONE HEATER		FEATURE CODE H557 ONE HEATER	
	HEATER AMPS	TOTAL WATTS	HEATER AMPS	TOTAL WATTS
208	18.0	3744	23.2	4825
240	20.8	4990	26.75	6420

⚠ A BATTERY CHARGER IS REQUIRED TO PREVENT BATTERY DISCHARGE

⚠ DO NOT ENERGIZE BATTERY CHARGER WITHOUT BATTERY BEING CONNECTED

ITEM	PART NO	QNG SIZE	DESCRIPTION OR MATERIAL	NOT REQ

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 0.8	.XX ±
	.XX ± 0.38	.XXX ±

HOLE		
	0.99- 4.99 ±0.15/-0.08	.004-.200 +.006/-.003
	5.00- 9.99 ±0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 ±0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 ±0.30/-0.13	.704-.999 +.012/-.005

ANG TOL± 1.0°

DRAWN TO SCALE OF 1/1

SIM TO 0630_2572 D

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THIRD ANGLE PROJECTION

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	NAME	DATE
DR	G_W_HUEBNER	04-02-03
CHKR / MFG	R BOOSE	04-02-03
APPROVED	R BOOSE	04-02-03

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON DFEG,EH,EJ,EK

SITE CODE PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE WD-INTERCONNECTION

DRG NO 0630_2592

SHEET 1 OF 11

DRG SIZE D

REL NO	LTR	NO	REVISION	ZONE	BY	CHKR	APPROVED	DATE
FRD16962	H	2	ADD SHEET 8	-	RMM	BG	PUNYKO	06-19-03
FRD22449	J	-	----------	--	--	--	--	--
FRD22293	K	8	REVISED PER ECOR	-	LJK	JEM	MILLER	01-28-05
FRD24920	L	1	REVISED PER ECOR	-	JFM	BN	B NESS	09-07-05
FRD30841	M	-	----------	-	JFM	JRS	SALCHOW	02-08-07
			REVISE FOR PCC3201		JEG			09-5-08

OTPC & BTPC UTILITY TO GENSET

GENSET PACKAGE WITH PCC3201

PCC INTERCONNECTION BOX

TB3

B+	1	1
B+	2	2
B+	3	3
B+	4	4
SWITCHED B+	5	5
SWITCHED B+	6	6
DELAYED OFF SWITCHED B+	7	7
DELAYED OFF SWITCHED B+	8	8
GND	9	9
GND	10	10
GND	11	11
GND	12	12

2-1

2-2

LONWORKS MODULE — TB6: 4 DATA 1, 5 DATA 2 (NOTE 6)

TB8 (BASE PCB) — TERMINAL BLOCK LOCATED ON CIRCUIT BOARD

REMOTE EMERGENCY SHUTDOWN SWITCH (WHEN NEEDED) — SEE NOTE 12

1-2

1-4

OPTIONAL COOLANT AND/OR ALTERNATOR HEATER(S)

STARTER — B+ (NOTE 9) 1-1; GND 1-3

AC SOURCES DESCRIBED ON SUBMITTAL DATA

FT-10 ANNUNCIATOR 0541-0814 — J1: B+ 3 (2-1), GND 6 (2-2); DATA1 1, DATA2 2

RUN #2 SEE NOTE 6

RUN #1 SEE NOTE 1

MOUNTED IN OTPC/BTPC CABINET

TB3

FOR CUSTOMER USE (SEE NOTE 5)

BATTERY CHARGER ALARMS (OPTIONAL)

AC LINE FAILURE	C	41	41
	NC	42	42
	NO	43	43
HI BATTERY VOLTAGE	C	44	44
	NC	45	45
	NO	46	46
LOW BATTERY VOLTAGE	C	47	47
	NC	48	48
	NO	49	49
		50	50
DATA1		51	51
DATA2		52	52

(SEE NOTE 6)

DO NOT CONNECT TO THIS SIDE

RELAY MODULE

	J14		J15	
SOURCE 1 CONNECTED	NO	1	16	COM
	COM	2	15	NO — LOAD SHED
	NC	3	14	COM
SOURCE 2 CONNECTED	NO	4	13	NO — FAIL TO CLOSE
	COM	5	12	NC
	NC	6	11	COM — FAIL TO SYNC. (OPT.)
SOURCE 1 AVAILABLE	NO	7	10	NO
	COM	8	9	NC
	NC	9	8	COM — FAIL TO DISCONN. (OPT.)
SOURCE 2 AVAILABLE	NO	10	7	NO
	COM	11	6	NC
	NC	12	5	COM — ELEVATOR PRE-TRANSFER
TEST OR EXERCISE ACTIVE	NO	13	4	NO
	COM	14	3	NC
	NC	15	2	COM — NOT IN AUTO
		16	1	NO

FOR CUSTOMER USE (SEE NOTE 11)

FOR CUSTOMER USE (SEE NOTE 11)

2 AMP, 12 AMP, 15 AMP CHARGER

(NOTE 13) REMOTE TEMPERATURE SENSER INPUT

(NOTE 14) COMMON ALARM OUTPUT CONTACT RATING 2 AMP AT 30 VDC

NOTE: TB3,J14 AND J15 ARE OPTIONAL AND ARE ONLY PROVIDED WHEN NEEDED FOR INSTALLED OPTIONS

REAR WALL OF CABINET

OTPC / BTPC

TB1

1	1	NO	TRANSFER SWITCH NORMAL AUXILIARY SWITCH
2	2	NC	
3	3	C	
4	4	NO	TRANSFER SWITCH EMERGENCY AUXILIARY SWITCH
5	5	NC	
6	6	C	
7	7	NO	BYPASS SWITCH NORMAL AUXILIARY SWITCH
8	8	NC	
	9	C	
	10	NO	BYPASS SWITCH EMERGENCY AUXILIARY SWITCH
	11	NC	
	12	C	

(SEE NOTE 10)

TB2

1	GND	
2	(SEE NOTE 8)	
3	B+	1-3
4	RMT	1-4
5	REMOTE TEST	1-1
6	TRANSFER INHIBIT	1-2
7	LOAD SHED (OPTIONAL)	SEE NOTE 4
8	COMMON	

REMOTE TEST SWITCH (WHEN USED)

(NOTE 1)

WIRE SIZE (AWG)	DISTANCE IN FEET, ONE WAY (MULTIPLY BY 0.3 FOR METERS)				
	A	B	C	D	E
16	1000	90	-	50	-
14	1600	150	20	80	5
12	2400	225	30	125	10
10	4000	350	50	200	15
8	-	600	80	300	25
6	-	1000	125	500	40

NOTES:

1. WIRE SIZES MUST BE AS FOLLOWS:
   RUN #1-GENSET TO TRANSFER SWITCH-LEAD SIZE MUST BE INCREASED IF A BATTERY CHARGER IS INSTALLED IN THE SWITCH.
   WITH NO BATT CHARGER-LEADS 1-1, -2, -3, -4, -5 USE COL A.
   WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1, &1-3 USE COL B.
   WITH 12/15 AMP CHARGER MAXIMUM VOLTAGE DROP OF 1.5 VOLTS, LEADS 1-1 & 1-3 USE COL. C.
   WITH 2 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, &1-3 USE COL D.
   WITH 12/15 AMP CHARGER, MAXIMUM VOLTAGE DROP OF 0.75 VOLTS, LEADS 1-1, & 1-3 USE COL E. TO MEET THE NFPA110 REQUIREMENT TO RETURN A FULLY DISCHARGED BATTERY TO 100% OF IT'S AMPERE-HOUR RATING WITHIN 24 HOURS USE COL. E.
2. IF OTPC NETWORK CARD IS USED, YOU MUST CONNECT B+ OR EXTERNAL BATTERY-BACKED POWER TO OTPC/BTPC DIGITAL BOARD AT P27.21 (B+) AND P27.22 (GND).
3. FOR MULTIPLE TRANSFER SWITCHES, DUPLICATE RUN #1 FOR EACH SWITCH. DAISY CHAIN CONNECTION IS ACCEPTABLE PROVIDED WIRE SIZE & DISTANCE TO THE LAST SWITCH MEET THE SPECS IN NOTE 1.
4. CONNECT AN OPEN DRY CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). FOR REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED. CLOSE TO ACTIVATE.
5. CONTACTS RATED: 4 AMPS AT 30 VDC OR 120V MAX.
6. REFER TO ONAN 900-0529 POWERCOMMAND NETWORK INSTALLATION & OPERATION MANUAL FOR WIRING INSTRUCTIONS, WIRE SIZE, AND LENGTH. USE STRANDED TWISTED PAIR WIRES WHEN CONNECTING DATA1 AND DATA2 TO NETWORK. PART # 0334-1350 OR EQUAL.
7. INPUTS FOR CUSTOMER FAULTS. GROUNDED SIGNAL REQUIRED TO ACTIVATE INPUT (MAX 50 MA.)
8. ON PCC 3201 CONTROLS NO JUMPER IS REQ'D BETWEEN TB2-1 & TB2-2.
9. CONFIGURATION SHOWN IS FOR ATS-MOUNTED BATTERY CHARGER. IF WALL-MOUNTED CHARGER IS USED, CONNECT B+ AND GND FROM CHARGER DIRECTLY TO BATTERY OR STARTER.
10. TRANSFER SWITCH SHOWN CLOSED TO NORMAL BYPASS SWITCH SHOWN NEUTRAL POSITION.
11. CONTACTS RATED: 2 AMPS AT 30 VDC OR 0.60 AMPS AT 120 VAC.
12. OPEN CONNECTION TO INITIATE EMERGENCY STOP. THESE TERMINALS MUST BE SHORTED TOGETHER IF REMOTE EMERGENCY STOP OPTION NOT USED. JUMPER SHOWN BETWEEN TB8-1 AND TB8-2 NOT SUPPLIED WITH UNIT.
13. 120VAC OR 240VAC AT 50W.
14. CUSTOMER SUPPLIED EITHER 12 OR 240VDC RELAYS OUTPUT SIGNAL 20ma @ 24VDC MAX.
15. USE THE INVENTER REMOTE TEMPERATURE PROBE (0193-0530).
16. THE FOLLOWING FAILS WILL CAUSE A BATTERY CHARGER ALARM OUTPUT:
    LOW BATTERY VOLTAGE, HIGH BATTERY VOLTAGE, LOW AC INPUT VOLTAGE, HIGH AC INPUT VOLTAGE OVERCURRENT, HIGH CHARGER TEMPERATURE, BATTERY FAILURE, HIGH BATTERY TEMPERATURE (NOT AVAILABLE ON 2 AMP CHARGER).

DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED		SIM TO 0630-1975	ITEM / PART NO / DWG SIZE / DESCRIPTION OR MATERIAL / REV	
	mm: X ± 1; X ± 0.8; XX ± 0.38 — Inch: X ±; XX ±; XXX ±		COPIED FROM 0630-1345	NAME / DATE	CUMMINS POWER GENERATION 1400 73RD AVE NE MINNEAPOLIS, MINNESOTA 55432
ANG TOL ± 1.0 °	MATERIAL: 0.09-0.59 +015/-008; 0.60-1.99 +020/-010; 2.00-17.49 +025/-010; 17.50-24.99 +030/-013 — .004-.230 +.006/-.003; .231-.421 +.008/-.004; .422-.743 +.010/-.005; .744-.999 +.012/-.005		THIRD ANGLE PROJECTION	DR L KAPLAN 05-21-99; CHKR / MFG L SMITH 05-21-99; APPROVED L SMITH 05-21-99	TITLE: WD-INTERCONNECTION
DRAWN TO SCALE OF 1/1			THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE REPLICATED, USED OR DISCLOSED UNLESS EXPRESSLY AUTHORIZED BY CUMMINS POWER GENERATION OR ITS REPRESENTATIVE.	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982 — MODEL FIRST USED ON: OTPC/BTPC	SITE CODE: PGA — DWG NO: 0630XXX_1974 — SHEET 8 — REV D

POWERCOMMAND NETWORKS

NETWORK CABLING AND CONNECTIONS FOR FTT-10 NETWORKS

Network Topology

FTT-10 networks are designed to support free topology wiring, and will accommodate bus, star, ring, or any combination of these topologies. Excepting the double-terminated bus topology, only one point of termination is required for any free topology segment. Note that the actual termination circuit will vary by application (See "Cable Termination" below.)

Network Nodes

Each device with an FTT-10 transceiver is a network node. The maximum number of nodes on a network segment and on the total network is partly dependant on the network application. For example, a network that is connecting only a few discrete variables between devices and has no monitoring software attached could probably support 64 nodes (maximum allowable on a segment per Echelon specs.) At the other extreme, a network with a large amount of inter-device bindings and being monitored by PowerCommand PULSE with Reporting option would not be able to support more than 12 devices using a single FTT-10 channel. However, with the appropriate addition of other network management devices, the PULSE example could potentially support 64 devices or even more. If there is any question about how many devices your network can support, contact the Network Applications Engineer in the CPG System Sales department.

Network Cable Selection

The following cables are qualified for use with FTT-10 networks:

- NEMA Level IV cable (Onan P/N 334-1350 [PVC] or 334-1351 [Plenum])
- Belden 85102 or Belden 8471 (both are single twisted pair)
- TIA Category 5 (CAT5)

Network wiring should be run in separate conduit and installed following local electrical codes. Any wire connected to Generator Sets must be stranded wire (NFPA110, Para. 7.12.4.1). Except when using ring topology, cabling is not polarity sensitive. The average temperature of the wire should not exceed +55ºC (+131ºF). Cable distance must comply with transmission specifications listed below. The *maximum total wire length* is the total length of wire within a segment. The *maximum node-to-node distance* is the maximum allowable distance between each individual node or the terminator.

Table 1 Free Topology

	Maximum node-to-node distance	**Maximum total Wire length**
Belden 8471 *	1300	1600
Belden 85102 *	1600	1600
NEMA Level IV	1300	1600
TIA Category 5	800	1400

* Optimal Cable

Table 2 Double-Terminated Bus Topology

	Maximum Bus length (Ft)
Belden 8471 *	8800
Belden 85102 *	8800
NEMA Level IV	4500
TIA Category 5	2900

A double-terminated bus may have stubs of up to 10 feet from the bus to each device.

* Optimal Cable

Cable Termination

FTT-10 network segments require termination for proper data transmission performance. Free topology and Double-terminated Bus topology networks differ in their termination requirements.

Free topology segments only require one terminator per segment. This terminator can be placed anywhere in the segment, but is recommended to be placed near the middle of the segment. All PowerCommand network interface modules (i.e. GCM, NCM, GLC), Control Communications Modules (CCM), Digital I/O Modules (DIM) and Lonworks Annunciators have an on-board free topology terminator. It is recommended that this be used on a free topology segment. Optionally an external free topology terminator (Onan P/N 0300-5669) can be used.

Double-terminated Bus segments must be terminated at both ends of the segment. An FTT-10 Bus terminator (Onan P/N 0300-5729) must be used.

OTPC 300 - QTY 2

Transfer switch OTPC open, closed, or delayed transition

> Specification sheet

40 - 4000 Amp

Our energy working for you.™

Cummins Power Generation

Description

OTPC transfer switches are designed for operation and switching of electrical loads between primary power and standby generator sets. They are suitable for use in emergency, legally required and optional standby applications. The switches monitor both power sources, signal generator set startup, automatically transfer power and return the load to the primary power source once the utility returns and is stabilized.

High-pressure silver alloy contacts can withstand thousands of switching cycles without burning, pitting or welding. They require no routine contact maintenance and provide 100% continuous current ratings.

The OTPC product line offers a transfer switch that is the right solution for every application. The switch is available in open, delayed and closed transitions.

UL	All switches are UL 1008 Listed with UL Type Rated cabinets and UL Listed CU-AL terminals.
CSA	All switches are certified to CSA 282 Emergency Electrical Power Supply for Buildings, up to 600 VAC.
NEC	Equipment shall be suitable for use in systems compliant to 700, 701 and 702.
NFPA	All switches comply with NFPA 70, 99 and 110.
NEMA	All switches comply with NEMA ICS 10.
IEEE	All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.
ISO 9001	This transfer switch is designed and manufactured in facilities certified to ISO9001.

Features

PowerCommand® control - A standard, fully featured microprocessor-based control. Software-enabled features, settings and adjustments are available for ease of setup and accuracy.

Robust control system design - Optically isolated logic inputs and high isolation transformers for AC power inputs provide high-voltage surge protection.

Communications capability - The transfer switch is capable of communicating with other transfer switches, accessories with a SCADA network or with Cummins Power Generation generators utilizing LonWorks® protocol.

Main contacts - Heavy-duty silver alloy contacts with separate arcing surfaces and multi-leaf arc chutes are rated for total system transfer including overload interruption.

Easy service/access - Plug connections, door-mounted controls, ample access space for all top and all bottom power connections, and compatible terminal markings. The control is field programmable.

Product lines, accessories and services - Cummins Power Generation offers a wide range of accessories and services to suit your requirements.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

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Transfer switch mechanism

- A bi-directional linear motor actuator powers OTPC Transfer Switches. This design provides virtually friction-free, constant force, straight-line transfer switch action with no complex gears or linkages.
- Independent break-before-make action is used for both 3-pole and 4-pole/switched neutral switches. On 3-pole/switched neutral switches, this action also prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs.
- A mechanical interlock prevents simultaneous closing of normal and emergency contacts.
- Long-life, high pressure, silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contacts are mechanically held in both normal and emergency positions for reliable, quiet operation.
- Superior arc interruption is accomplished through multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases and prevent inter-phase flashover.

Specifications

Voltage rating	Transfer switches rated from 40 A through 4000 A are rated up to 600 VAC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes cool and quench the arcs. Covers prevent interphase flashover and are transparent for visual inspection.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two contacts (one for each source) are provided for customer use. Wired to terminal block for easy access. Rated at 10A continuous and 250 VAC maximum.
Operating temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95% relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Surge withstand ratings	Surge-tested for location category B3, per IEEE C 62.41. Testing per IEEE 62.45. Control tested to European Surge Test EN 61000-4-5.
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without programmed transition installed.
Manual operation handles	Transfer switches rated through 1000 A are equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation. Transfer switches over 1000 A are equipped with manual operators for service use only under de-energized conditions.

Open transition - The OTPC automatic transfer switch, equipped with in-phase monitor, determines when to transfer the load from one source to another. The switch contacts operate in a break-before-make sequence[1].

Delayed (programmed) transition - The OTPC is also available as a delayed transition transfer switch. The delayed transition OTPC completely disconnects the load from both sources for an adjustable period of time to allow regenerative voltage to decay to a safe level prior to connecting to the new source. By allowing motor fields to decay, nuisance tripping breakers and load damage are prevented. Delayed transition transfer is recommended by NEMA MG-1.

Closed transition - Closed transition transfer is required in applications with loads sensitive to momentary power interruptions. The switch contacts operate in a make-before-break sequence. The OTPC with closed transition allows the seamless transfer of critical loads from one source to another by paralleling the two sources momentarily (for less than 100 msecs).

[1] The standard OTPC below 1000 amps is field-configurable for either delayed or in-phase transition.

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PowerCommand microprocessor control

PowerCommand controls are microprocessor based and developed specifically for automatic transfer switch operation. The control provides features and options useful for most applications. Flash memory is used to store control settings. The contents of the memory are not lost even if power to the controller is lost. There is also an on-board battery to maintain the real-time clock setting and the engine start time delay. A choice of two control packages allows flexibility for determining the most suitable level of control for a given application:

Level 1 control (C023)

Open transition (in-phase transition)
Delayed transition (programmed transition)
Utility-to-genset applications
Software adjustable time delays:
- Engine start: 0 to 15 sec
- Transfer normal to emergency: 0 to120 sec
- Retransfer emergency to normal: 0 to 30 min
- Engine stop: 0 to 30 min
- Delayed transition: 0 to 60 sec

Undervoltage sensing - 3-phase normal, 1-phase emergency
- Pickup: 85% to 98% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0.1 to 1.0 sec

Overvoltage sensing - 3-phase normal, 1-phase emergency
- Dropout: 105% to 135% of nominal voltage
- Pickup: 95% to 99% of dropout setting
- Dropout time delay: 0.5 to 120 sec

Over/under frequency sensing
- Pickup: ±5% to ±20% of nominal frequency
- Dropout: ±1% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Programmable genset exerciser - One event/schedule with or w/o load
Basic indicator panel
- Source available/connected LED indicators
- Test/exercise/bypass buttons
- Digital display - optional
- Analog bargraph metering - optional

Date/time-stamped event recording - 50 events
Load sequencing (optional with network communications module)

Level 2 control (C024)

Open transition (in-phase transition)
Delayed transition (programmed transition)
Closed transition
Utility-to-genset applications
Utility-to-utility applications
Genset-to-genset applications
Software adjustable time delays:
- Engine start: 0 to 120 sec
- Transfer normal to emergency: 0 to 120 sec
- Retransfer emergency to normal: 0 to 30 min
- Engine stop: 0 to 30 min
- Programmed transition: 0 to 60 sec

Undervoltage sensing - 3-phase normal, 3-phase emergency
- Pickup: 85% to 98% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0.1 to 1.0 sec

Overvoltage sensing - 3-phase normal, 3-phase emergency
- Dropout: 105% to 135% of nominal voltage
- Pickup: 95% to 99% of dropout setting
- Dropout time delay: 0.5 to 120 sec

Over/under frequency sensing
- Pickup: ±5% to ±20% of nominal frequency
- Dropout: ±1% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Voltage imbalance sensing
- Dropout: 2% to 10%
- Pickup: 90% of dropout
- Time delay: 2.0 to 20.0 sec

Phase rotation sensing
- Time delay: 100 msec

Loss of single phase detection
- Time delay: 100 msec

Programmable genset exerciser - Eight events/schedules with or w/o load
Basic indicator panel
- Source available/connected LED indicators
- Test/exercise/bypass buttons
- Digital display - standard
- Analog bargraph metering - optional

Date/time-stamped event recording - 50 events
Load sequencing (optional with Network Communications Module)

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Time-delay functions

Engine start: Prevents nuisance genset starts in the event of momentary power system variation or loss. Not included in utility-to-utility systems.

Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems.

Retransfer emergency to normal: Allows the utility to stabilize before retransfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems.

Engine stop: Maintains availability of the genset for immediate reconnection in the event that the normal source fails shortly after retransfer. Allows gradual genset cool down by running unloaded. Not included in utility-to-utility systems.

Delayed (programmed) transition: Transfers load to neutral position, disconnected from sources, to allow inductive load voltages to decay.

Fail to disconnect timer: Signals external device to disconnect either the genset or utility to prevent extended operation in parallel with the utility.

User interfaces

Basic interface panel

LED indicators provide at-a-glance source and transfer switch status for quick summary of system conditions. Test and override buttons allow delays to be bypassed for rapid system checkout.

Digital display (M018) ←

The digital display provides a convenient method for monitoring load power conditions, adjusting transfer switch parameters, monitoring PowerCommand network status or reviewing transfer switch events. Password protection limits access to adjustments to authorized personnel. The digital display comes standard with the Level 2 PowerCommand microprocessor control and is optional with the level 1 control.

User interface options

Front panel security key (M017)

Front panel access can be locked out using this option. Prevents unauthorized transfers or testing. Prevents unauthorized adjustments via the digital display.

Analog bar graph meter (D009)

An LED bar graph display provides easy to read indication for normal and emergency voltages and frequencies, load currents, power factor, and kilowatts. Green, amber, and red LEDs provide at-a-glance indication of system acceptability. Available as an option with the Level 2 PowerCommand microprocessor control.

Control options

Relay signal module (M023) ←

Provides an adjustable transfer pre-signal time delay of 0 to 60 seconds to prevent interruption of power during elevator operation. Relay outputs include: Source 1 Connected and Available, Source 2 Connected and Available, Not in Auto, Test/Exercise Active, Failed to Disconnect, Failed to Synchronize, Failed to Transfer/Retransfer, and Transfer pre-signal (elevator signal).

Loadshed (M007) ←

Removes the load from the emergency power source by driving the transfer switch to the neutral position when signaled remotely. Transfers load back to the emergency source when the signal contacts open. Immediate retransfer to the preferred source when it is re-established.

PowerCommand network interface (M031) ←

Provides connection to the PowerCommand network. LonWorks compatible for integration into customer monitoring strategy.

Load power and load current monitoring (M022)

Measures load phase and neutral, current, power factor, real power (kW) and apparent power (kVA). Warns of excessive neutral current resulting from unbalanced or nonlinear loads.

* Note: Some options may not be available on all models - consult factory for availability.

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UL withstand and closing ratings

The transfer switches listed below must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and closing ratings (WCR) are stated in symmetrical RMS amperes.

	MCCB protection			Current limited breaker protection		
Transfer switch ampere	**WCR @ volts max with specific manufacturers MCCBs**	**Max MCCB rating**	**Drawing reference**	**With specific current limiting breakers (CLB)**	**Max CLB rating**	**Drawing reference**
40, 70, 125 3-pole	14,000 @ 480 14,000 @ 600	225 A	0098-6885	200,000 @ 480 100,000 @ 600	225 A	0098-6918
40, 70, 125 4-pole	30,000 @ 480 30,000 @ 600	400 A	0098-6886	200,000 @ 480 100,000 @ 600	400 A	0098-6919
150, 225, 260	30,000 @ 480 30,000 @ 600	400 A	0098-6886	200,000 @ 480 100,000 @ 600	400 A	0098-6919
300, ~~400,~~ 600	65,000 @ 480 65,000 @ 600	1200 A	0098-6887	200,000 @ 480 100,000 @ 600	1200 A	0098-6920
800, 1000	65,000 @ 480 50,000 @ 600	1400 A	0098-6888	150,000 @ 480 100,000 @ 600	1400 A	0098-6921
1000, 1200	85,000 @ 480 65,000 @ 600	1600 A	0098-7312	85,000 @ 480 65,000 @ 600	1600 A	0098-7312
1600, 2000	100,000 @ 480 85,000 @ 600	4000 A	0098-7311	100,000 @ 480 85,000 @ 600	4000 A	0098-7311
3000	100,000 @ 480 85,000 @ 600	4000 A	0098-7313	100,000 @ 480 85,000 @ 600	4000 A	0098-7313
4000	100,000 @ 480 85,000 @ 600	5000 A	0098-8576	100,000 @ 480	5000 A	0098-8576

Fuse protection

Transfer switch ampere	**WCR @ volts max. with current limiting fuses**	**Max fuse, size and type**	**Drawing reference**
40, 70, 125 3- and 4-pole	200,000 @ 480 200,000 @ 600	200 A Class, J, RK1, RK5	0098-6885
150, 225, 260	200,000 @ 480 200,000 @ 600	600 A Class, J, RK1, RK5 1200 A Class L	0098-6886
300, ~~400,~~ 600	200,000 @ 480 200,000 @ 600	1200 A Class L 1200 A Class L	0098-6887
800, 1000	200,000 @ 480 200,000 @ 600	2000 A Class L	0098-6888
1000, 1200	200,000 @ 480 150,000 @ 600	3000 A Class L	0098-7312
1600, 2000	200,000 @ 480 150,000 @ 600	2500 A Class L	0098-7311
3000	200,000 @ 480 150,000 @ 600	4000 A Class L	0098-7313
4000	200,000 @ 480 150,000 @ 600	6000 A Class L	0098-8576

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3 cycle ratings

Transfer switch ampere	WCR @ volts max 3 cycle rating	Max MCCB rating	Drawing reference
1000, 1200	50,000 @ 480 42,000 @ 600	1600 A	0098-7312
1600, 2000	100,000 @ 480 85,000 @ 600	4000 A	0098-7311
3000	100,000 @ 480 85,000 @ 600	4000 A	0098-7313
4000	100,000 @ 480 85,000 @ 600	5000 A	098-8576

Transfer switch lug capacities

All lugs accept copper or aluminum wire unless indicated otherwise.

Amp rating	Cables per phase	Size
40, 70, 125 3-pole	1	#12 AWG-2/0
40 4-pole	1	#14 AWG-2/0
70, 125 4-pole	1	#6 AWG - 300 MCM
150, 225	1	#6 AWG - 300 MCM
260	1	#6 AWG - 400 MCM
300, 400	1	3/0 - 600 MCM
	2	3/0 - 250 MCM
600	2	250 - 500 MCM
800, 1000	4	250 - 500 MCM
1000, 1200	4	#2 AWG to 600 MCM
1600, 2000	8	#2 AWG to 600 MCM (lugs optional)
3000	8	#2 AWG to 600 MCM (lugs optional)
4000	12	#2 AWG to 600 MCM (lugs optional)

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Enclosures

The transfer switch and control are mounted in a key-locking enclosure. Wire bend space complies with 2008 NEC.

Dimensions - transfer switch in UL type 1 enclosure

Amp rating	Height		Width		Depth				Weight		Outline drawing
					Door closed		Door open				
	in	mm	in	mm	in	mm	in	mm	lb	kg	
40, 70, 125 3-pole	27.0	686	20.5	521	12.0	305	31.5	800	82	37	0310-0544
40, 70, 125 4-pole	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0500-4896
150, 225	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0310-0414
260	43.5	1105	28.5	724	16.0	406	43.0	1093	170	77	0310-0540
300, 400, 600	54.0	1372	25.5	648	18.0	457	42.0	1067	225	102	0310-1307
800, 1000	68.0	1727	30.0	762	20.6	524	48.5	1232	360	163	0310-0417
1000, 1200	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	0310-0482
1600, 2000*	90.0	2290	36.0.	915	48.0	1219	84.0	2134	1100	499	0310-0483
3000*	90.0	2290	36.0	915	48.0	1219	84.0	2134	1250	567	0310-0484
4000*	90.0	2290	46.5	1180	60.0	1520	106	2700	1850	839	0500-4485

Dimensions - transfer switch in UL type 3R, 4 or 12 enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	34.0	864	26.5	673	12.5	318	36.5	927	125	57	3R, 12,	0310-0453
40, 70, 125 4-pole	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0500-4896
											4	0500-4896
150, 225	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0310-0454
											4	0310-0446
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	3R, 12	0310-0455
											4	0310-0447
300, 400, 600	59.0	1499	27.5	699	16.5	419	41.5	1054	275	125	3R, 12	0310-1315
											4	0310-1316
800, 1000	73.5	1867	32.5	826	20.8	529	49.5	1257	410	186	3R, 12	0310-0457
											4	0310-0449
1000, 1200	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	3R, 12, 4	0310-0482
1600, 2000*	90.0	2290	35.5	826	50.9	1293	80.0	2032	1100	499	3R, 12, 4	0310-0744
3000*	90.0	2290	38.0	965	51.0	1295	84.5	2146	1250	567	3R	0310-0745
4000*	90.0	2290	49.0	1244	60.0	1524	105	2654	1850	839	3R	0500-4486

Dimensions - transfer switch in UL type 4X stainless steel enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
40, 70, 125 4-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4896
150, 225	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
300, 400, 600	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
800, 1000	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
1000, 1200	70.0	1778	40.0	1016	19.8	502	59.0	1499	450	204	4X	0306-5309
1600,2000	90.0	2290	35.5	826	50.9	1293	80.0	2032	1100	499	4X	0310-0744

* Rear or side access is required to complete power wiring installations.

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Submittal detail – options (accessories specification sheet AC-167)

Amperage ratings
- ☐ 40
- ☐ 70
- ☐ 125
- ☐ 150
- ☐ 225
- ☐ 260
- ☐ 300
- ☐ 400
- ☐ 600
- ☐ 800
- ☐ 1000
- ☐ 1200
- ☐ 1600
- ☐ 2000
- ☐ 3000
- ☐ 4000

Voltage ratings
- ☐ R020 120*
- ☐ R038 190
- ☐ R021 208
- ☐ R022 220
- ☐ R023 240
- ☐ R024 380
- ☐ R025 416
- ☐ R035 440
- ☐ R026 480
- ☐ R027 600

* Line to neutral voltage (not available on 1200-1500 amp switches)

Pole configuration
- ☐ A028 Poles - 3 (solid neutral)
- ☐ A029 Poles - 4 (switched neutral)

Frequency
- ☐ A044 60 Hertz
- ☐ A045 50 Hertz

Transfer mode
- ☐ A077 In phase transition (open transition)
- ☐ A078 Delayed transition (programmed transition)
- ☐ A079 Closed transition (available 1000-4000 amps, for closed transition below 1000 amps, see CHPC spec sheet S-1437)

Application
- ☐ A035 Utility to genset
- ☐ A036 Utility to utility
- ☐ A037 Genset to genset

System options
- ☐ A041 Single Phase, 2-wire or 3-wire (not available 1200-4000 amps)
- ☐ A042 Three Phase, 3-wire or 4-wire

Enclosure
- ☐ B001 Type 1: General purpose indoor (similar to IEC type IP30)
- ☐ B002 Type 3R: Intended for outdoor use (dustproof and rainproof) (Similar to IEC type IP34)
- ☐ B003 Type 4: Indoor or outdoor use (watertight) (Similar to IEC type IP65)
- ☐ B004 Open Construction: No enclosure - includes automatic transfer switch and controls
- ☐ B010 Type 12: Indoor use, dust-tight and drip-tight (similar to IEC type IP61)
- ☐ B025 Type 4X: Indoor or outdoor use (watertight) (similar to IEC Type IP65)

Standards
- ☐ A046 UL 1008/CSA certification
- ☐ A064 NFPA 20 compliant (not available 1200-4000 A)
- ☐ A080 Seismic certification

Controls
- ☐ C023 Switch control - level 1
- ☐ C024 Switch control - level 2

Control options
- ☐ M017 Security key - front panel
- ☐ M018 Display - digital
- ☐ M022 Monitoring - load
- ☐ M023 Module - relay
- ☐ M031 Communications - LonWorks Network Communications Module (FTT-10)

Meters
- ☐ D009 Digital bar graph meters

Battery chargers
- ☐ K001 2 A, 12/24 V
- ☐ KB59 15 A, 12 V
- ☐ KB60 12 A, 24 V

Protective relays
- ☐ M036 62PL relay
- ☐ M038 86 Lock-out relay

Auxiliary relays - Relays are UL Listed and factory installed. All relays provide (2) normally open and (2) normally closed isolated contacts rated 10 A @ 600 VAC. Relay terminals accept (1) 18 gauge to (2) 12 gauge wires per terminal.
- ☐ L101 24 VDC coil - installed, not wired (for customer use).
- ☐ L102 24 VDC coil - emergency position - relay energized when ATS in source 2 (emergency) position.
- ☐ L103 24 VDC coil - normal position - relay energized when ATS in source 1 (normal) position
- ☐ L201 12 VDC coil - installed, not wired
- ☐ L202 12 VDC coil - emergency position - relay energized when ATS in source 2 (emergency) position
- ☐ L203 12 VDC coil - normal position - relay energized when ATS in source 1 (normal) position

Miscellaneous options
- ☐ M003 Terminal block - 30 points (not wired)
- ☐ M007 Load shed - from emergency - drives switch to neutral position when remote signal contact closes
- ☐ N009 Power connect - bus stabs (150-1200 amp open construction only)
- ☐ N013 Extension harness

Optional lug kits
- ☐ N008 Terminal lugs - cable (1600-3000 amps only)
- ☐ N020 Terminal block - retransfer inhibit

Warranty
- ☐ G002 One year basic
- ☐ G004 Two year comprehensive
- ☐ G006 Five year basic
- ☐ G007 Five year comprehensive
- ☐ G008 Ten year major components

Shipping
- ☐ A051 Packing - export box

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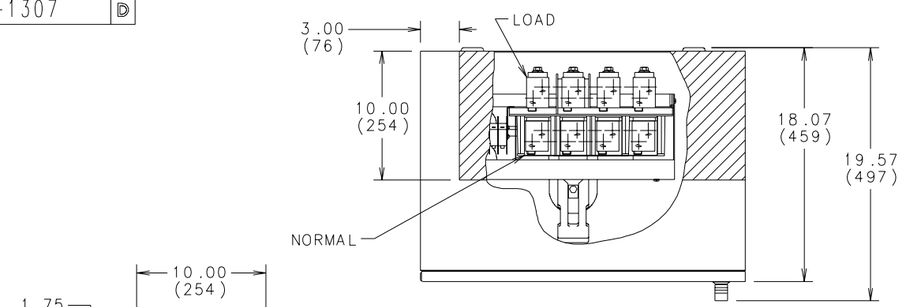
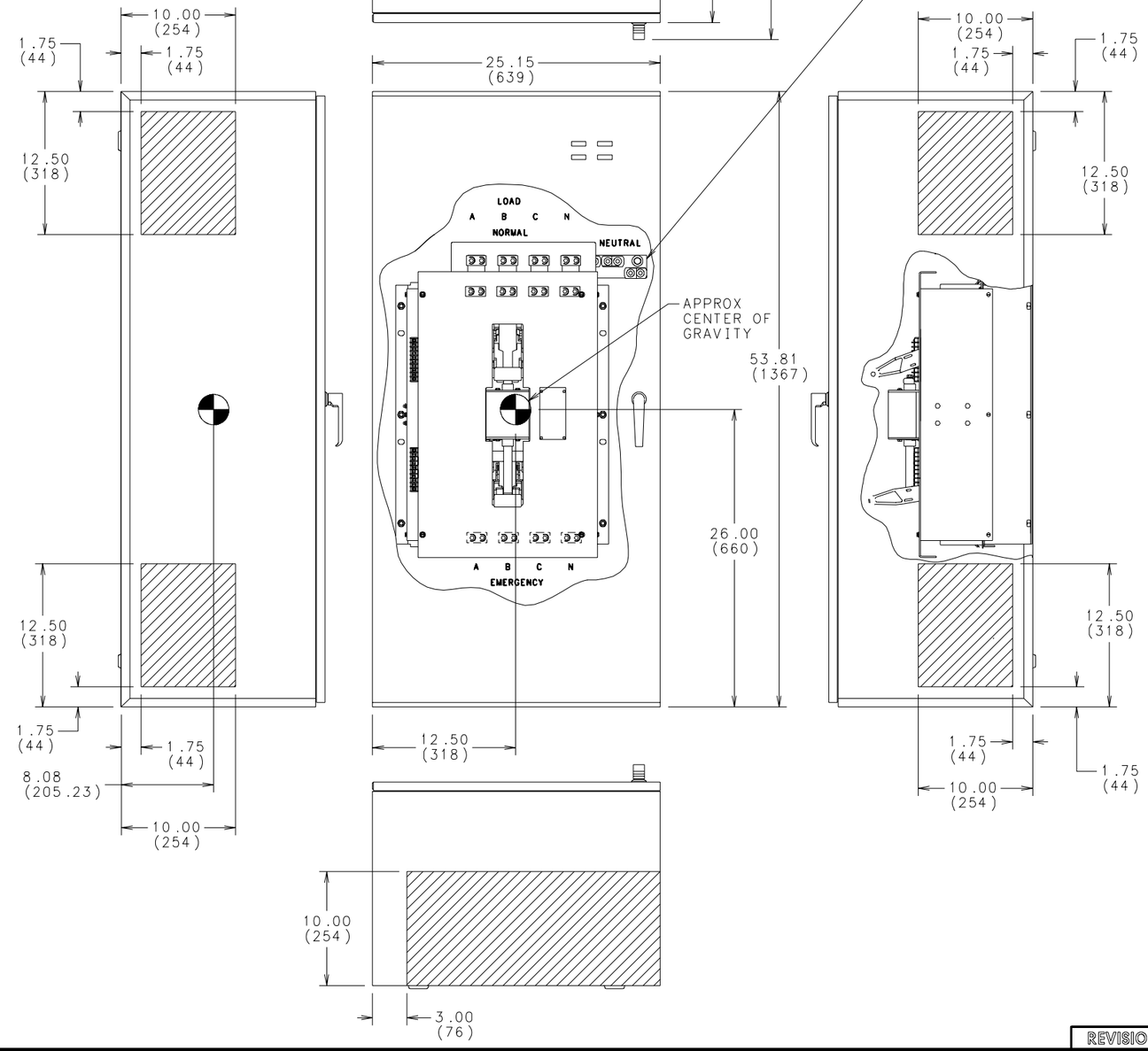
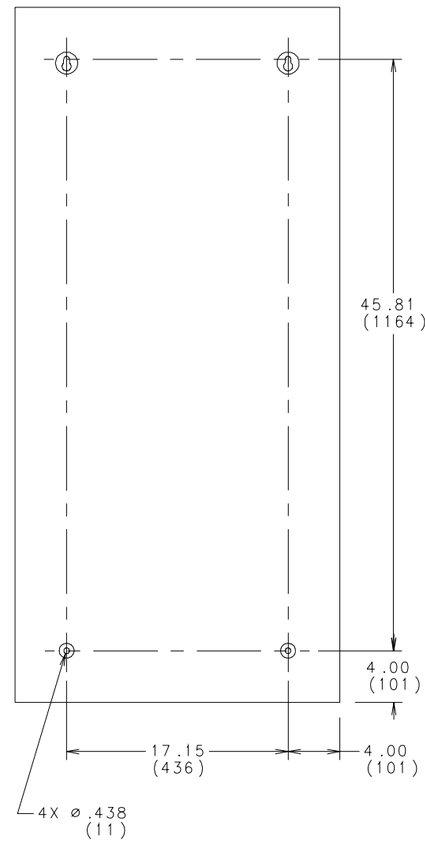
0310-1307 D

ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD1608	A	1	PRODUCTION RELEASE	-	LK	LHS	L.SWITH	05-19-99
FRD5274	B	1	WAS 4-250 (120) MCM CU-AL QTY 1	2-C	DD	LHS	L.SWITH	04-13-00
FRD1737T	C	1	DIM 18.07 (459) WAS 18.07 (499)	4-D	RWM	BG	L.SWITH	08-05-03
		2	DIM 19.57 (497) WAS 19.57 (459)	4-D	RWM	BG	L.SWITH	08-05-03



SOLID NEUTRAL BAR SUPPLIED WITH 3 POLE MODELS ONLY.





NOTES:

1. UL TYPE 1 ENCLOSURE
2. APPROX. WEIGHT: 225 LBS
   MASS: 102 kg
3. DIMENSIONS IN ( ) ARE MILLIMETRES.
4. LUG CAPACITY: 300, 400 AMP
   (QUANTITY 1 WIRE) 3/0-600 (95-300) MCM CU-AL
   (QUANTITY 2 WIRES) 3/0-250 (25-120) MCM CU-AL
   LUG CAPACITY: 600 AMP
   (QUANTITY 2 WIRES) 250-500 (120-240) MCM CU-AL.
5. USE SEPARATE CONDUITS FOR CONTROL WIRING AND POWER WIRING. DO NOT COMBINE.
6. SHADED AREA INDICATES WIRING AND CABLE ENTRANCE AREA DO NOT INSTALL OUTSIDE OF SHADED AREA.
7. WIRE BENDING SPACE CONFORMS TO NEC TABLE 373-6 (B).
8. REFER TO NATIONAL ELECTRIC CODE, ARTICLE 110-16 WHICH STATES THE REQUIREMENT FOR THE MINIMUM CLEAR SPACE IN FRONT OF THIS UNIT.
9. 4 POLE SWITCHED NEUTRAL TRANSFER SWITCH SHOWN. A SOLID NEUTRAL BAR IS PROVIDED WITH 3 POLE TRANSFER SWITCHES.

3 AND 4 POLE

REVISIO DWG

QTY	ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

mm	Inch
X ±	.X ±
.X ±	.XX ±
.XX ±	.XXX ±
0.00-6.99 ±0.25/-0.08	.000-.200 ±.006/-.003
7.00-9.99 ±0.25/-0.13	.201-.431 ±.008/-.004
10.00-17.49 ±0.25/-0.13	.432-.782 ±.010/-.005
17.50-24.99 ±0.38/-0.13	.784-.999 ±.012/-.005

ANG TOL ±

DRAWN TO SCALE OF 3/16

SW TO

COPIED FROM 0310-0416 D

THIRD ANGLE PROJECTION

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	NAME	DATE
DR	L. KAPLAN	05-18-99
CHKR ☒ MFG ☐	L. SMITH	05-18-99
APPROVED	L. SMITH	05-18-99

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON OTPC 300-600A

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE OUTLINE-CONTROL BOX

DWG NO. 0310-1307 SHEET 1 of 1 DWG SIZE D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

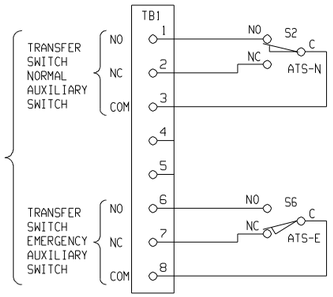
CUSTOMER CONNECTIONS

AUXILIARY CONTACTS

MOUNTED ON FRONT OF TRANSFER SWITCH. AVAILABLE ON ALL UNITS.

FOR CUSTOMER USE

TRANSFER SWITCH AUXILIARY CONTACTS RATED: 10 AMPS, 250 VAC



UTILITY TO GENERATOR

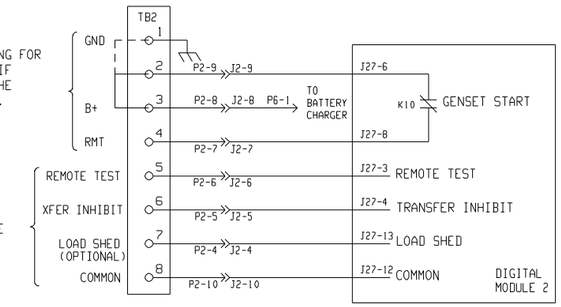
TO ENGINE GENERATOR CONTROL

REFER TO THE INTERCONNECTION DRAWING FOR PROPER INSTALLATION OF WIRING AND IF NEEDED, JUMPER LOCATION, BETWEEN THE GENSET CONTROL AND TRANSFER SWITCH.

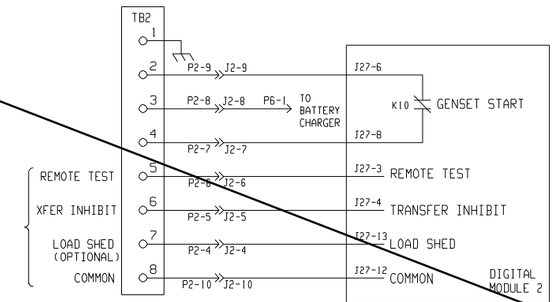
ON PARALLELING SYSTEMS. REFER TO SYSTEM INTERCONNECTION DRAWING FOR CORRECT WIRING.

FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.



UTILITY TO UTILITY

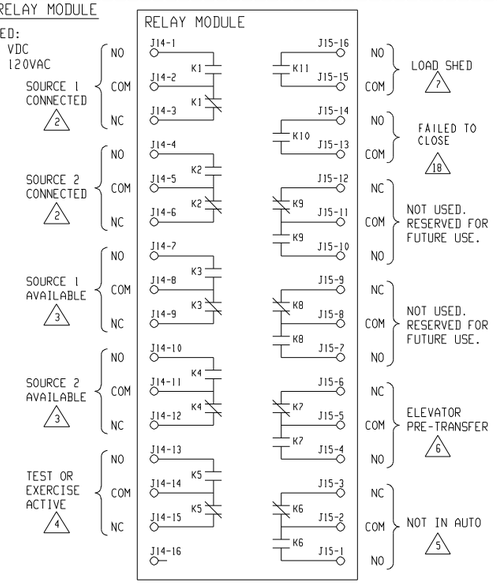


FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.

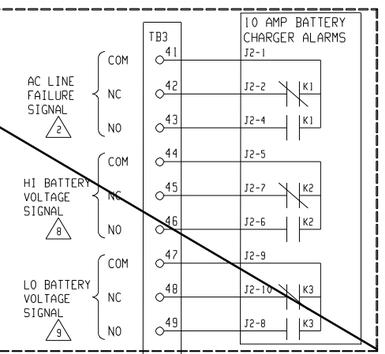
OPTIONAL: RELAY MODULE

CONTACTS RATED:
2 AMPS AT 30 VDC
0.60 AMPS AT 120VAC



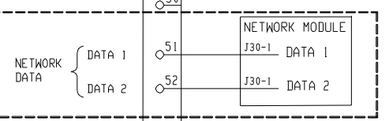
OPTIONAL: 10 AMP BATTERY CHARGER ALARMS

CONTACTS RATED:
4 AMPS AT 30 VDC OR 120VAC MAX



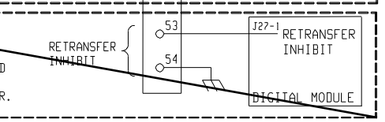
OPTIONAL: NETWORK MODULE

USE TWISTED PAIR



OPTIONAL: RETRANSFER INHIBIT

CONNECT A JUMPER OR A CLOSED CONTACT BETWEEN TB3-53 AND TB3-54 TO INHIBIT RETRANSFER.



REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	ADD NOTE 18	B-2	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	ADDED OPTIONAL BATTERY CHARGER	3B	SDM	IAM	MILLER	11-26-04
		2	ADDED NOTES 19 & 20	2B	SDM	IAM	MILLER	11-26-04

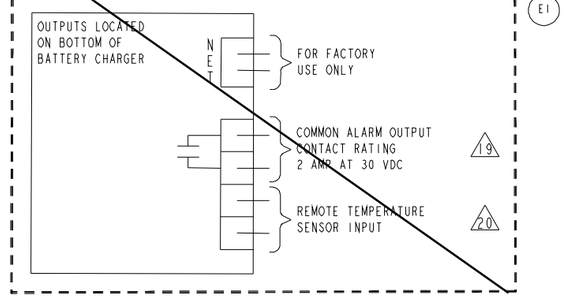
NOTES:

1. TB1 AND TB2 ARE MOUNTED ON THE FRONT OF THE TRANSFER SWITCH. TB3 IS MOUNTED ON THE LEFT INSIDE PANEL OF THE ENCLOSURE.
2. SHOWN WITH SOURCE NOT CONNECTED.
3. SHOWN WITH SOURCE NOT AVAILABLE.
4. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING TEST OR EXERCISE PERIOD.
5. SHOWN WITH CONTROL IN AUTOMATIC MODE. CONTACTS CHANGE STATE WHEN CONTROL IS NOT IN AUTO.
6. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE FOR AN ADJUSTABLE TIME BEFORE LOAD TRANSFER OCCURS.
7. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING LOAD SHED.
8. SHOWN UNDER NORMAL BATTERY VOLTAGE CONDITION. CONTACTS TRANSFER UNDER A HIGH BATTERY VOLTAGE CONDITION.
9. SHOWN UNDER A LOW BATTERY VOLTAGE CONDITION.
10. SEE SHEET 2.
11. SEE SHEET 2.
12. SEE SHEET 2.
13. SEE SHEET 4.
14. SEE SHEET 4.
15. SEE SHEET 5.
16. SEE SHEET 5.
17. SEE SHEET 5.
18. (D2) SHOWN NOT ACTIVE, CONTACT CHANGES STATE DURING A FAILED TO TRANSFER OR FAILED TO RETRANSFER EVENT.
19. (E2) THE FOLLOWING WILL CAUSE A BATTERY CHARGER ALARM OUTPUT:
    LOW BATTERY VOLTAGE
    HIGH BATTERY VOLTAGE
    LOW AC INPUT VOLTAGE
    HIGH AC INPUT VOLTAGE
    OVERCURRENT
    HIGH CHARGER TEMPERATURE
    BATTERY FAILURE
    HIGH BATTERY TEMPERATURE ; NOT AVAILABLE ON 2 AMP CHARGER
20. USE THE INVENTER REMOTE TEMPERATURE PROBE. (PART NO. 0193-0530)

LEVEL 2 CONTROL
DISPLAY MODULE
3 AND 4 POLE
40-600 AMP
120 VOLT 1 PHASE L-N
240 VOLT 1 PHASE
190 VOLT 3 PHASE
208 VOLT 3 PHASE
220 VOLT 3 PHASE
240 VOLT 3 PHASE
380 VOLT 3 PHASE
415 VOLT 3 PHASE
440 VOLT 3 PHASE
480 VOLT 3 PHASE

OPTIONS:
NETWORK MODULE
LOAD SHED
RELAY MODULE
BAR GRAPH
LOAD CURRENT MODULE
BATTERY CHARGER
BATTERY CHARGER ALARMS
RETRANSFER INHIBIT

OPTIONAL: BATTERY CHARGER ALARM 2 AMP, 12 AMP, 15 AMP

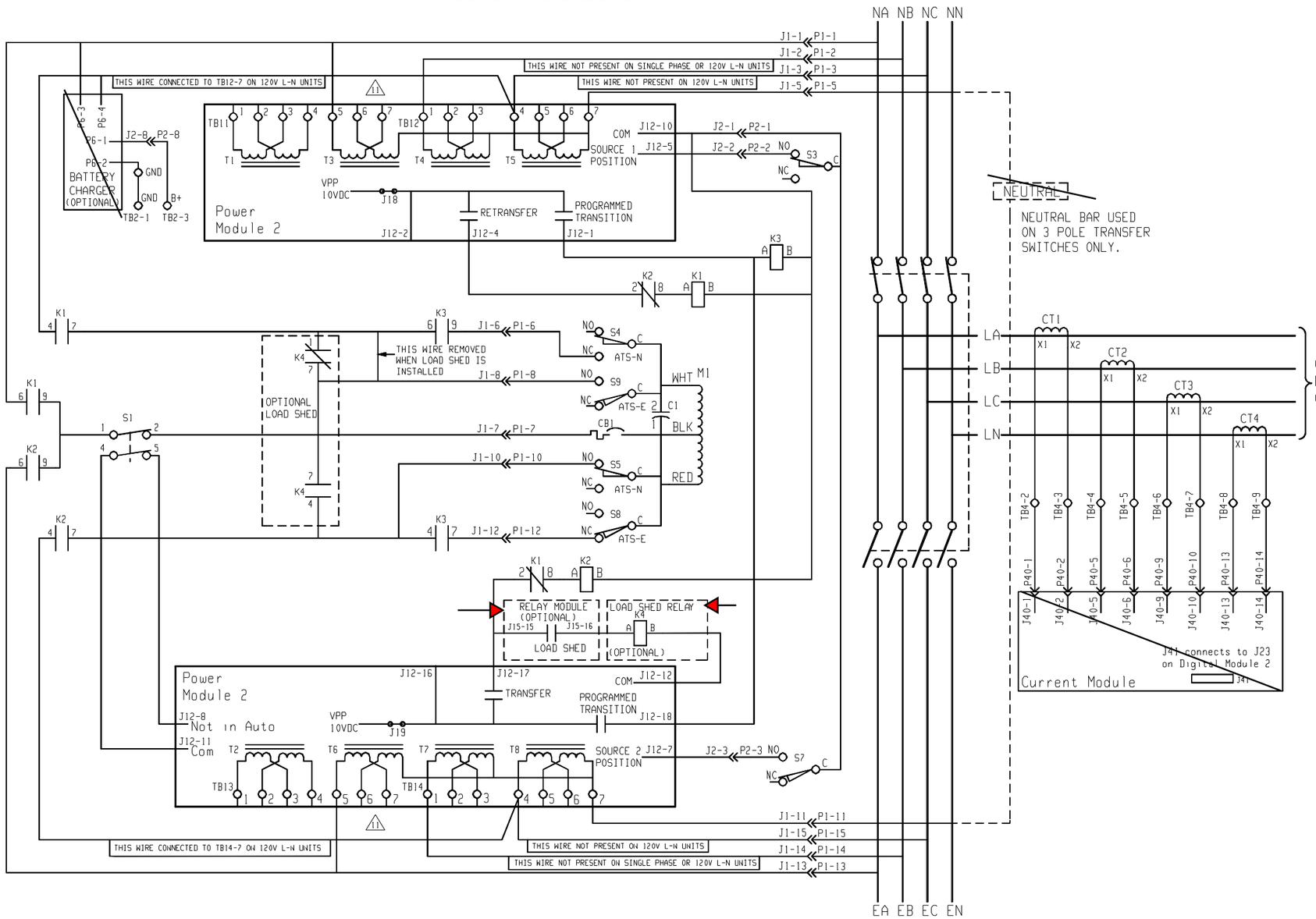


DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED				SIM TO	ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	NOT REQ
	DIM	mm	inch		COPIED FROM					
		X ± 1	.X ±							
		.X ± 1	.XX ±		THIRD ANGLE PROJECTION					
ANG TOL± 1°		.XX ± 1	.XXX±				NAME	DATE	CUMMINS	CUMMINS POWER GENERATION
	HOLE	0.99- 4.99 +0.15/-0.08	.004-.200 +.006/-.003			DR	S D MORE	11/26/04		1400 73RD AVE NE MINNEAPOLIS, MINNESOTA 55432
DRAWN TO SCALE OF 1/1		5.00- 9.99 +0.20/-0.10	.201-.421 +.008/-.004			CHKR ED MFG	I A MAHADESHWAR	11/26/04		
		10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005			APPROVED	MILLER	11/26/04	SITE CODE	TITLE: WD-TRANSFER SWITCH
		17.50-24.99 +0.30/-0.13	.704-.999 +.012/-.005		THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN EXPRESSLY AUTHORIZED BY CUMMINS POWER GENERATION OR ITS REPRESENTATIVE	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982	MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC		PGA	DRG NO 0626_2311	SHEET 1 of 5	DRG SIZE D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

SCHEMATIC DIAGRAM



K3 PROGRAMMED TRANSITION RELAY

K1 TRANSFER TO NORMAL RELAY

M1 LINEAR MOTOR

C1 MOTOR RUN CAPACITOR

CB1 CIRCUIT BREAKER

S1 LINEAR MOTOR DISABLE

K2 TRANSFER TO EMERGENCY RELAY

K4 LOAD SHED RELAY

NOTES:

10. ALL DEVICES ARE SHOWN DE-ENERGIZED, WITH THE TRANSFER SWITCH CLOSED TO NORMAL. 4 POLE TRANSFER SWITCH SHOWN. ON 3 POLE MODELS THE SWITCHED NEUTRAL POLE IS REPLACED WITH A SOLID NEUTRAL BAR.

11. SEE SHEET 3 FOR TRANSFORMER PRIMARY JUMPERS.

12. FOR SINGLE PHASE UNITS:
120/240, 3 WIRE - CONNECT POWER CABLES TO A AND C
120 L-N, 2 WIRE - CONNECT POWER CABLES TO A AND NEUTRAL

DO NOT SCALE PRINT

ANG TOL± 1°

DRAWN TO SCALE OF 1/1

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±
MALE	0.00-4.99 ±0.15/-0.08	.004-.200 +.006/-.003
	5.00-9.99 ±0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 ±0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 ±0.30/-0.13	.704-.999 +.012/-.005

ITEM	PART NO	QNG SITE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

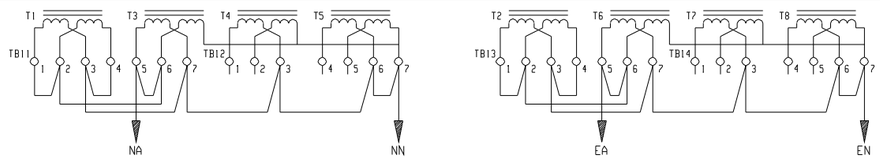
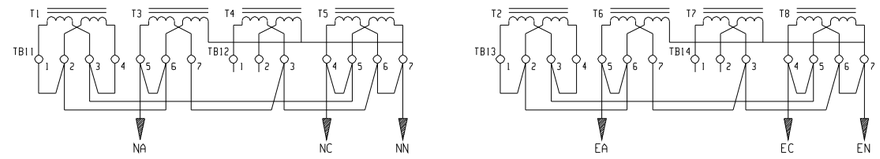
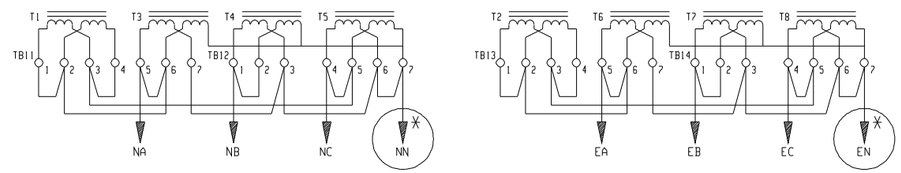
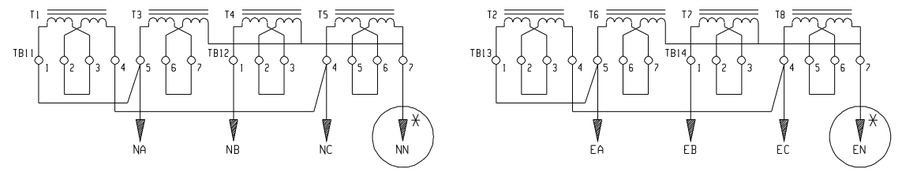
DRG NO: 0626_2311

SHEET: 2 OF 5

DRG SIZE: D

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	RMVD NOTE 2 DELTA JUMPER WIRE	C-1	JM	LHS	LHS	10-22-02
		4	RMVD NOTE DO NOT ADD DELTA WIRE	C-1	JM	LHS	LHS	10-22-02
		5	EC WAS EB	B-3	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

POWER MODULE 2 FACTORY TRANSFORMER CONNECTIONS

LINE TO LINE VOLTAGE	
120 VAC L-N 2 WIRE	
240 VAC 1 PHASE 3 WIRE	
190-240 VAC 3 PHASE 4 WIRE	
380-480 VAC 3 PHASE 4 WIRE	

SEE 0626-2312 FOR 600 VOLT CONNECTIONS.

*CONNECTIONS FOR SPECIAL WYE AND DELTA APPLICATIONS

APPLICATION	POWER MODULE WIRING CHANGES
4-WIRE, 3-PHASE WYE WITH GROUNDED NEUTRAL	NO WIRING CHANGES NECESSARY THIS IS THE FACTORY CONFIGURATION
3-WIRE, 3-PHASE DELTA OR WYE WITH NO NEUTRAL OR UNGROUNDED NEUTRAL	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.
4-WIRE, 3-PHASE DELTA WITH GROUNDED NEUTRAL OR 3-WIRE, 3 PHASE DELTA WITH A GROUNDED CORNER.	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.

(D3) (D4) (D5)

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	NOT REQ

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±

HOLE			
ANG TOL± 1°	0.99- 4.99	±0.15/-0.08	.004-.200	+.006/-.003
DRAWN TO SCALE OF 1/1	5.00- 9.99	±0.20/-0.10	.201-.421	+.008/-.004
	10.00-17.49	±0.25/-0.13	.422-.703	+.010/-.005
	17.50-24.99	±0.30/-0.13	.704-.999	+.012/-.005

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ED MFG	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

DRG NO: 0626_2311

SHEET: 3 of 5

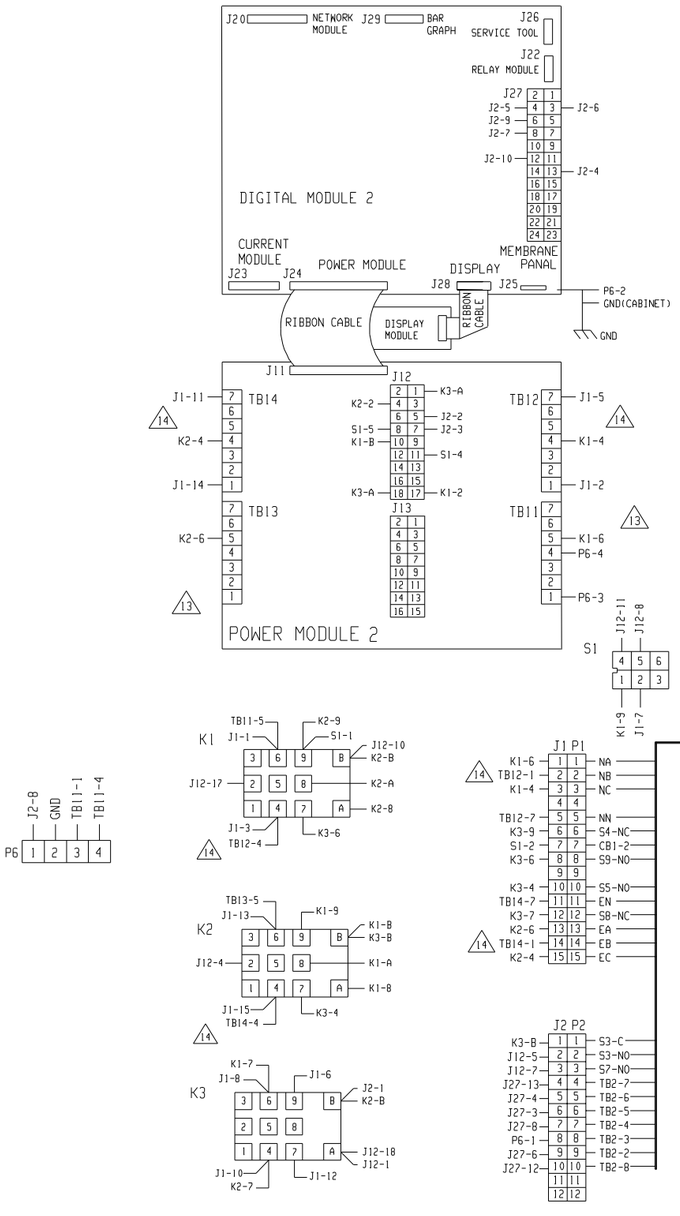
DRG SIZE: D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

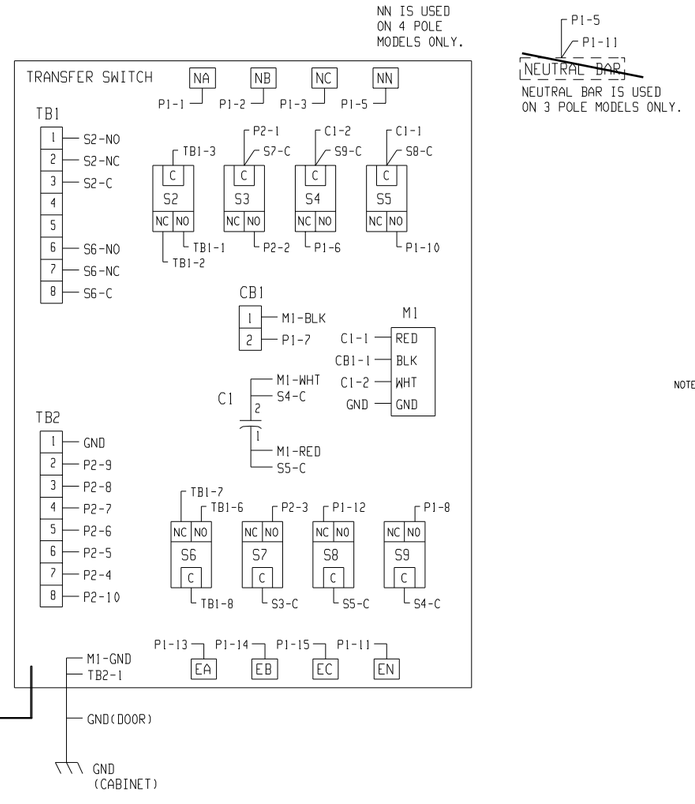
STANDARD WIRING

REAR VIEW OF DOOR



LEFT SIDEWALL

REAR WALL OF CABINET



NEUTRAL BAR IS USED ON 3 POLE MODELS ONLY.

NOTES:

13. SEE SHEET 3 FOR TB11, TB12, TB13 AND TB14 JUMPER CONNECTIONS.

14. ON ALL SINGLE PHASE, 2 OR 3-WIRE UNITS: THE WIRES CONNECTED FROM J1-2 TO TB12-1 AND FROM J1-14 TO TB14-1 ARE NOT PRESENT.

IN ADDITION, ON 120 VOLT L-N, 2-WIRE UNITS: THE WIRES CONNECTED FROM J1-3 TO K1-4 AND FROM J1-15 TO K2-4 ARE NOT PRESENT. THE WIRE CONNECTED FROM K1-4 TO TB12-4 WILL BE CONNECTED FROM K1-4 TO TB12-7 AND THE WIRE CONNECTED FROM K2-4 TO TB14-4 WILL BE CONNECTED FROM K2-4 TO TB14-7.

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

ANG TOL± 1°

DRAWN TO SCALE OF 1/1

TOLERANCE UNLESS OTHERWISE SPECIFIED	mm	inch
DIM	X ± 1 .X ± 1 .XX ± 1	.X ± .XX ± .XXX±
HOLE	0.00-4.99 ±0.15/-0.38 5.00-9.99 ±0.20/-0.10 10.00-17.49 ±0.25/-0.13 17.50-24.99 ±0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.783 +.010/-.005 .784-.999 +.012/-.005

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A 120-480 VAC

SPEC A

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

DWG NO: 0626_2311

SHEET 4 of 5

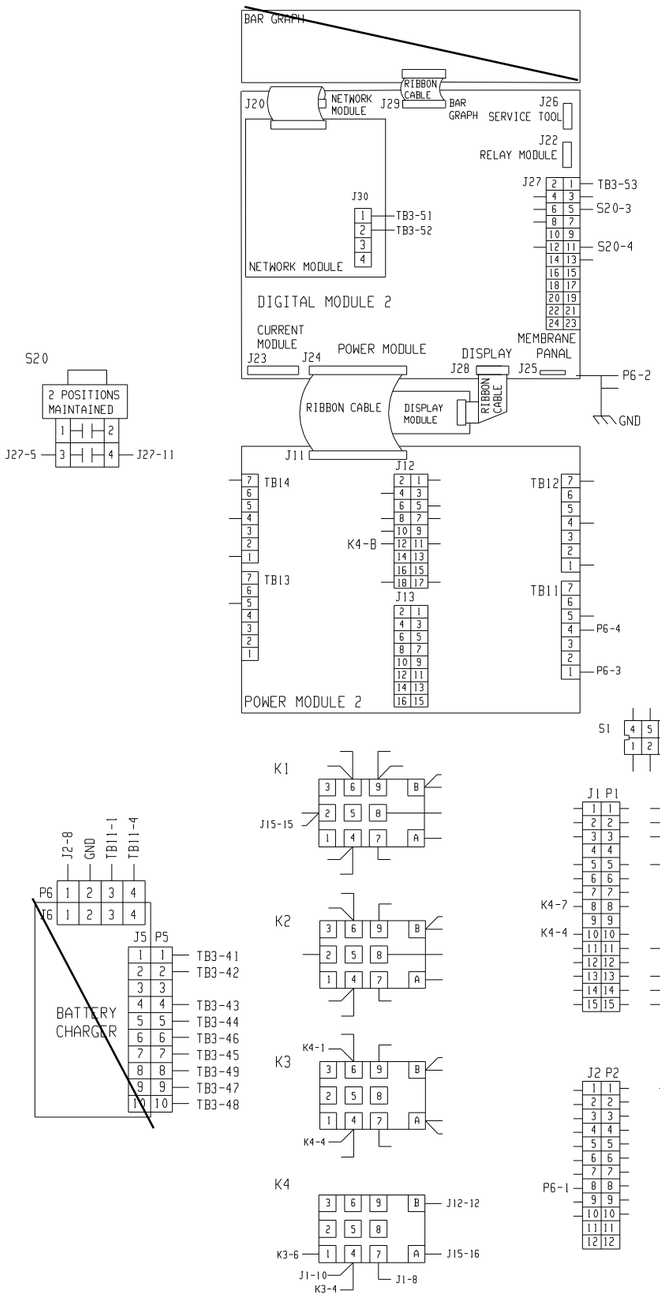
DWG SIZE: D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

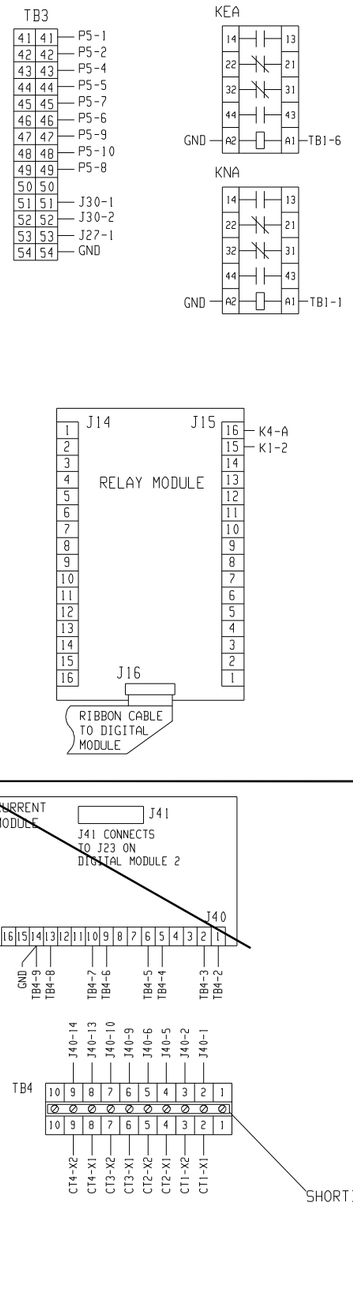
OPTION WIRING

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

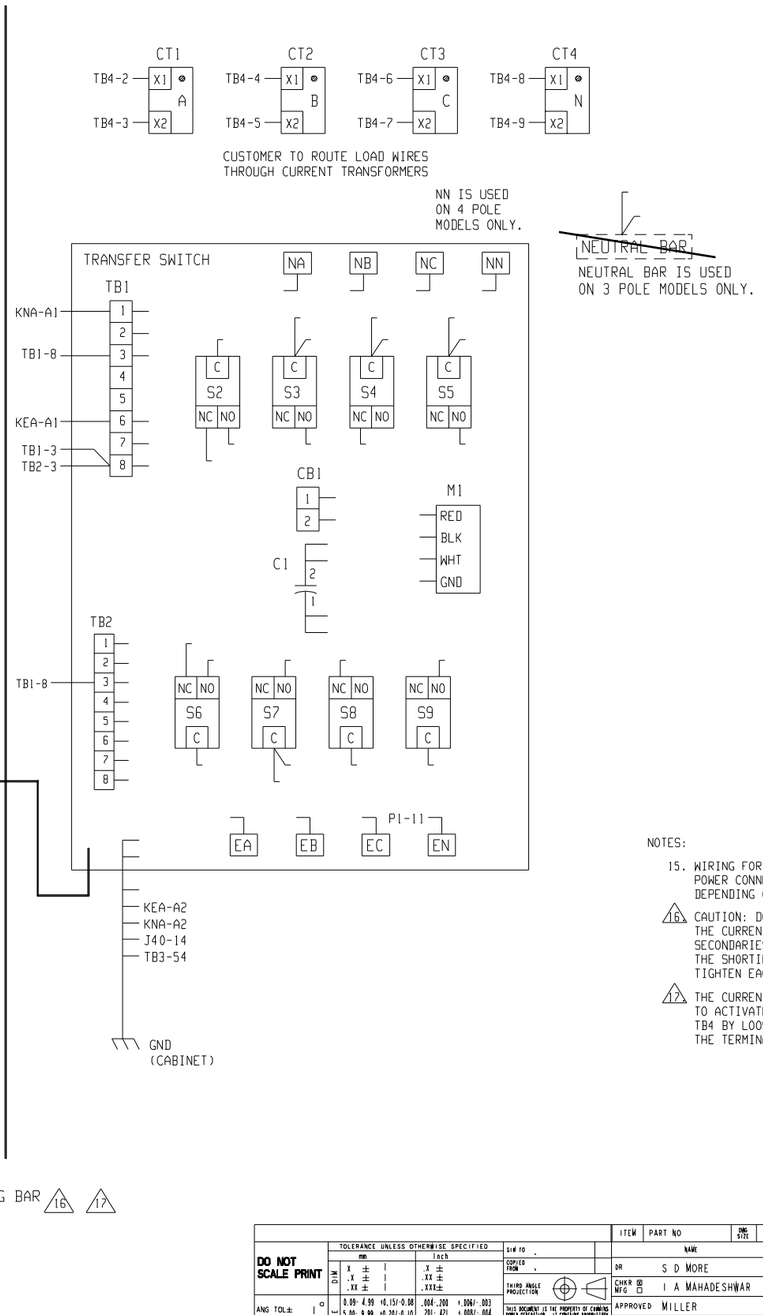
REAR VIEW OF DOOR



LEFT SIDEWALL



REAR WALL OF CABINET



NOTES:

15. WIRING FOR RELAYS KNA AND KEA IS TYPICAL. POWER CONNECTIONS TO COILS MAY VARY SLIGHTLY DEPENDING ON THE NUMBER OF RELAYS INSTALLED.

16. CAUTION: DO NOT DISCONNECT THE CURRENT MODULE WHILE THE CURRENT TRANSFORMERS ARE ENERGIZED UNLESS THE SECONDARIES ARE SHORTED. TO SHORT SECONDARIES ATTACH THE SHORTING BAR TO THE CENTER OF TB4 BEING SURE TO TIGHTEN EACH SCREW.

17. THE CURRENT TRANSFORMERS ARE SHORTED DURING SHIPPING. TO ACTIVATE, REMOVE THE SHORTING BAR FROM THE CENTER OF TB4 BY LOOSENING ALL OF THE SCREWS AND LIFTING IT OUT OF THE TERMINAL BLOCK. SAVE FOR REUSE.

ITEM	PART NO	QNTY SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±
ANG TOL ±	1°	
HOLE	0.89-4.99 +0.15/-0.08	.004-.200 +.006/-.003
	5.00-9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 +0.38/-0.13	.704-.999 +.0127-.005

DRAWN TO SCALE OF 1/1

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD_TRANSFER SWITCH

DRG NO: 0626_2311

SHEET: 5 of 5

DRG SIZE: D

Transfer switch OTPC open, closed, or delayed transition

> Specification sheet

40 - 4000 Amp

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Description

OTPC transfer switches are designed for operation and switching of electrical loads between primary power and standby generator sets. They are suitable for use in emergency, legally required and optional standby applications. The switches monitor both power sources, signal generator set startup, automatically transfer power and return the load to the primary power source once the utility returns and is stabilized.

High-pressure silver alloy contacts can withstand thousands of switching cycles without burning, pitting or welding. They require no routine contact maintenance and provide 100% continuous current ratings.

The OTPC product line offers a transfer switch that is the right solution for every application. The switch is available in open, delayed and closed transitions.

UL	All switches are UL 1008 Listed with UL Type Rated cabinets and UL Listed CU-AL terminals.
CSA	All switches are certified to CSA 282 Emergency Electrical Power Supply for Buildings, up to 600 VAC.
NEC	Equipment shall be suitable for use in systems compliant to 700, 701 and 702.
NFPA	All switches comply with NFPA 70, 99 and 110.
NEMA	All switches comply with NEMA ICS 10.
IEEE	All switches comply with IEEE 446 Recommended Practice for Emergency and Standby Power Systems.
ISO 9001	This transfer switch is designed and manufactured in facilities certified to ISO9001.

Features

PowerCommand® control - A standard, fully featured microprocessor-based control. Software-enabled features, settings and adjustments are available for ease of setup and accuracy.

Robust control system design - Optically isolated logic inputs and high isolation transformers for AC power inputs provide high-voltage surge protection.

Communications capability - The transfer switch is capable of communicating with other transfer switches, accessories with a SCADA network or with Cummins Power Generation generators utilizing LonWorks® protocol.

Main contacts - Heavy-duty silver alloy contacts with separate arcing surfaces and multi-leaf arc chutes are rated for total system transfer including overload interruption.

Easy service/access - Plug connections, door-mounted controls, ample access space for all top and all bottom power connections, and compatible terminal markings. The control is field programmable.

Product lines, accessories and services - Cummins Power Generation offers a wide range of accessories and services to suit your requirements.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

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Transfer switch mechanism

- A bi-directional linear motor actuator powers OTPC Transfer Switches. This design provides virtually friction-free, constant force, straight-line transfer switch action with no complex gears or linkages.
- Independent break-before-make action is used for both 3-pole and 4-pole/switched neutral switches. On 3-pole/switched neutral switches, this action also prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs.
- A mechanical interlock prevents simultaneous closing of normal and emergency contacts.
- Long-life, high pressure, silver alloy contacts resist burning and pitting. Separate arcing surfaces further protect the main contacts. Contacts are mechanically held in both normal and emergency positions for reliable, quiet operation.
- Superior arc interruption is accomplished through multiple leaf arc chutes that cool and quench the arcs. Barriers separate the phases and prevent inter-phase flashover.

Specifications

Voltage rating	Transfer switches rated from 40 A through 4000 A are rated up to 600 VAC, 50 or 60 Hz.
Arc interruption	Multiple leaf arc chutes cool and quench the arcs. Covers prevent interphase flashover and are transparent for visual inspection.
Neutral bar	A full current-rated neutral bar with lugs is standard on enclosed 3-pole transfer switches.
Auxiliary contacts	Two contacts (one for each source) are provided for customer use. Wired to terminal block for easy access. Rated at 10A continuous and 250 VAC maximum.
Operating temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Storage temperature	-40 °F (-40 °C) to 140 °F (60 °C)
Humidity	Up to 95% relative, non-condensing
Altitude	Up to 10,000 ft (3,000 m) without derating
Surge withstand ratings	Surge-tested for location category B3, per IEEE C 62.41. Testing per IEEE 62.45. Control tested to European Surge Test EN 61000-4-5.
Total transfer time (source-to-source)	Will not exceed 6 cycles at 60 Hz with normal voltage applied to the actuator and without programmed transition installed.
Manual operation handles	Transfer switches rated through 1000 A are equipped with permanently attached operating handles and quick-break, quick-make contact mechanisms suitable for manual operation. Transfer switches over 1000 A are equipped with manual operators for service use only under de-energized conditions.

Open transition - The OTPC automatic transfer switch, equipped with in-phase monitor, determines when to transfer the load from one source to another. The switch contacts operate in a break-before-make sequence[1].

Delayed (programmed) transition - The OTPC is also available as a delayed transition transfer switch. The delayed transition OTPC completely disconnects the load from both sources for an adjustable period of time to allow regenerative voltage to decay to a safe level prior to connecting to the new source. By allowing motor fields to decay, nuisance tripping breakers and load damage are prevented. Delayed transition transfer is recommended by NEMA MG-1.

Closed transition - Closed transition transfer is required in applications with loads sensitive to momentary power interruptions. The switch contacts operate in a make-before-break sequence. The OTPC with closed transition allows the seamless transfer of critical loads from one source to another by paralleling the two sources momentarily (for less than 100 msecs).

[1] The standard OTPC below 1000 amps is field-configurable for either delayed or in-phase transition.

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PowerCommand microprocessor control

PowerCommand controls are microprocessor based and developed specifically for automatic transfer switch operation. The control provides features and options useful for most applications. Flash memory is used to store control settings. The contents of the memory are not lost even if power to the controller is lost. There is also an on-board battery to maintain the real-time clock setting and the engine start time delay. A choice of two control packages allows flexibility for determining the most suitable level of control for a given application:

Level 1 control (C023)

Open transition (in-phase transition)
Delayed transition (programmed transition)
Utility-to-genset applications
Software adjustable time delays:
- Engine start: 0 to 15 sec
- Transfer normal to emergency: 0 to120 sec
- Retransfer emergency to normal: 0 to 30 min
- Engine stop: 0 to 30 min
- Delayed transition: 0 to 60 sec

Undervoltage sensing - 3-phase normal, 1-phase emergency
- Pickup: 85% to 98% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0.1 to 1.0 sec

Overvoltage sensing - 3-phase normal, 1-phase emergency
- Dropout: 105% to 135% of nominal voltage
- Pickup: 95% to 99% of dropout setting
- Dropout time delay: 0.5 to 120 sec

Over/under frequency sensing
- Pickup: ±5% to ±20% of nominal frequency
- Dropout: ±1% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Programmable genset exerciser - One event/schedule with or w/o load
Basic indicator panel
- Source available/connected LED indicators
- Test/exercise/bypass buttons
- Digital display - optional
- Analog bargraph metering - optional

Date/time-stamped event recording - 50 events
Load sequencing (optional with network communications module)

Level 2 control (C024)

Open transition (in-phase transition)
Delayed transition (programmed transition)
Closed transition
Utility-to-genset applications
Utility-to-utility applications
Genset-to-genset applications
Software adjustable time delays:
- Engine start: 0 to 120 sec
- Transfer normal to emergency: 0 to 120 sec
- Retransfer emergency to normal: 0 to 30 min
- Engine stop: 0 to 30 min
- Programmed transition: 0 to 60 sec

Undervoltage sensing - 3-phase normal, 3-phase emergency
- Pickup: 85% to 98% of nominal voltage
- Dropout: 75% to 98% of pickup setting
- Dropout time delay: 0.1 to 1.0 sec

Overvoltage sensing - 3-phase normal, 3-phase emergency
- Dropout: 105% to 135% of nominal voltage
- Pickup: 95% to 99% of dropout setting
- Dropout time delay: 0.5 to 120 sec

Over/under frequency sensing
- Pickup: ±5% to ±20% of nominal frequency
- Dropout: ±1% beyond pickup
- Dropout time delay: 0.1 to 15.0 sec

Voltage imbalance sensing
- Dropout: 2% to 10%
- Pickup: 90% of dropout
- Time delay: 2.0 to 20.0 sec

Phase rotation sensing
- Time delay: 100 msec

Loss of single phase detection
- Time delay: 100 msec

Programmable genset exerciser - Eight events/schedules with or w/o load
Basic indicator panel
- Source available/connected LED indicators
- Test/exercise/bypass buttons
- Digital display - standard
- Analog bargraph metering - optional

Date/time-stamped event recording - 50 events
Load sequencing (optional with Network Communications Module)

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Time-delay functions

Engine start: Prevents nuisance genset starts in the event of momentary power system variation or loss. Not included in utility-to-utility systems.

Transfer normal to emergency: Allows genset to stabilize before application of load. Prevents power interruption if normal source variation or loss is momentary. Allows staggered transfer of loads in multiple transfer switch systems.

Retransfer emergency to normal: Allows the utility to stabilize before retransfer of load. Prevents needless power interruption if return of normal source is momentary. Allows staggered transfer of loads in multiple transfer switch systems.

Engine stop: Maintains availability of the genset for immediate reconnection in the event that the normal source fails shortly after retransfer. Allows gradual genset cool down by running unloaded. Not included in utility-to-utility systems.

Delayed (programmed) transition: Transfers load to neutral position, disconnected from sources, to allow inductive load voltages to decay.

Fail to disconnect timer: Signals external device to disconnect either the genset or utility to prevent extended operation in parallel with the utility.

User interfaces

Basic interface panel

LED indicators provide at-a-glance source and transfer switch status for quick summary of system conditions. Test and override buttons allow delays to be bypassed for rapid system checkout.

Digital display (M018)

The digital display provides a convenient method for monitoring load power conditions, adjusting transfer switch parameters, monitoring PowerCommand network status or reviewing transfer switch events. Password protection limits access to adjustments to authorized personnel. The digital display comes standard with the Level 2 PowerCommand microprocessor control and is optional with the level 1 control.

User interface options

Front panel security key (M017)

Front panel access can be locked out using this option. Prevents unauthorized transfers or testing. Prevents unauthorized adjustments via the digital display.

Analog bar graph meter (D009)

An LED bar graph display provides easy to read indication for normal and emergency voltages and frequencies, load currents, power factor, and kilowatts. Green, amber, and red LEDs provide at-a-glance indication of system acceptability. Available as an option with the Level 2 PowerCommand microprocessor control.

Control options

Relay signal module (M023)

Provides an adjustable transfer pre-signal time delay of 0 to 60 seconds to prevent interruption of power during elevator operation. Relay outputs include: Source 1 Connected and Available, Source 2 Connected and Available, Not in Auto, Test/Exercise Active, Failed to Disconnect, Failed to Synchronize, Failed to Transfer/Retransfer, and Transfer pre-signal (elevator signal).

Loadshed (M007)

Removes the load from the emergency power source by driving the transfer switch to the neutral position when signaled remotely. Transfers load back to the emergency source when the signal contacts open. Immediate retransfer to the preferred source when it is re-established.

PowerCommand network interface (M031)

Provides connection to the PowerCommand network. LonWorks compatible for integration into customer monitoring strategy.

Load power and load current monitoring (M022)

Measures load phase and neutral, current, power factor, real power (kW) and apparent power (kVA). Warns of excessive neutral current resulting from unbalanced or nonlinear loads.

* Note: Some options may not be available on all models - consult factory for availability.

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UL withstand and closing ratings

The transfer switches listed below must be protected by circuit breakers or fuses. Referenced drawings include detailed listings of specific breakers or fuse types that must be used with the respective transfer switches. Consult with your distributor/dealer to obtain the necessary drawings. Withstand and closing ratings (WCR) are stated in symmetrical RMS amperes.

	MCCB protection			Current limited breaker protection		
Transfer switch ampere	**WCR @ volts max with specific manufacturers MCCBs**	**Max MCCB rating**	**Drawing reference**	**With specific current limiting breakers (CLB)**	**Max CLB rating**	**Drawing reference**
40, 70, 125 3-pole	14,000 @ 480 14,000 @ 600	225 A	0098-6885	200,000 @ 480 100,000 @ 600	225 A	0098-6918
40, 70, 125 4-pole	30,000 @ 480 30,000 @ 600	400 A	0098-6886	200,000 @ 480 100,000 @ 600	400 A	0098-6919
150, 225, 260	30,000 @ 480 30,000 @ 600	400 A	0098-6886	200,000 @ 480 100,000 @ 600	400 A	0098-6919
300, 400, 600	65,000 @ 480 65,000 @ 600	1200 A	0098-6887	200,000 @ 480 100,000 @ 600	1200 A	0098-6920
800, 1000	65,000 @ 480 50,000 @ 600	1400 A	0098-6888	150,000 @ 480 100,000 @ 600	1400 A	0098-6921
1000, 1200	85,000 @ 480 65,000 @ 600	1600 A	0098-7312	85,000 @ 480 65,000 @ 600	1600 A	0098-7312
1600, 2000	100,000 @ 480 85,000 @ 600	4000 A	0098-7311	100,000 @ 480 85,000 @ 600	4000 A	0098-7311
3000	100,000 @ 480 85,000 @ 600	4000 A	0098-7313	100,000 @ 480 85,000 @ 600	4000 A	0098-7313
4000	100,000 @ 480 85,000 @ 600	5000 A	0098-8576	100,000 @ 480	5000 A	0098-8576

Fuse protection

Transfer switch ampere	**WCR @ volts max. with current limiting fuses**	**Max fuse, size and type**	**Drawing reference**
40, 70, 125 3- and 4-pole	200,000 @ 480 200,000 @ 600	200 A Class, J, RK1, RK5	0098-6885
150, 225, 260	200,000 @ 480 200,000 @ 600	600 A Class, J, RK1, RK5 1200 A Class L	0098-6886
300, 400, 600	200,000 @ 480 200,000 @ 600	1200 A Class L 1200 A Class L	0098-6887
800, 1000	200,000 @ 480 200,000 @ 600	2000 A Class L	0098-6888
1000, 1200	200,000 @ 480 150,000 @ 600	3000 A Class L	0098-7312
1600, 2000	200,000 @ 480 150,000 @ 600	2500 A Class L	0098-7311
3000	200,000 @ 480 150,000 @ 600	4000 A Class L	0098-7313
4000	200,000 @ 480 150,000 @ 600	6000 A Class L	0098-8576

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3 cycle ratings

Transfer switch ampere	WCR @ volts max 3 cycle rating	Max MCCB rating	Drawing reference
1000, 1200	50,000 @ 480 42,000 @ 600	1600 A	0098-7312
1600, 2000	100,000 @ 480 85,000 @ 600	4000 A	0098-7311
3000	100,000 @ 480 85,000 @ 600	4000 A	0098-7313
4000	100,000 @ 480 85,000 @ 600	5000 A	098-8576

Transfer switch lug capacities

All lugs accept copper or aluminum wire unless indicated otherwise.

Amp rating	Cables per phase	Size
40, 70, 125 3-pole	1	#12 AWG-2/0
40 4-pole	1	#14 AWG-2/0
70, 125 4-pole	1	#6 AWG - 300 MCM
150, 225	1	#6 AWG - 300 MCM
260	1	#6 AWG - 400 MCM
300, 400	1	3/0 - 600 MCM
	2	3/0 - 250 MCM
600	2	250 - 500 MCM
800, 1000	4	250 - 500 MCM
1000, 1200	4	#2 AWG to 600 MCM
1600, 2000	8	#2 AWG to 600 MCM (lugs optional)
3000	8	#2 AWG to 600 MCM (lugs optional)
4000	12	#2 AWG to 600 MCM (lugs optional)

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Enclosures

The transfer switch and control are mounted in a key-locking enclosure. Wire bend space complies with 2008 NEC.

Dimensions - transfer switch in UL type 1 enclosure

Amp rating	Height		Width		Depth				Weight		Outline drawing
					Door closed		Door open				
	in	mm	in	mm	in	mm	in	mm	lb	kg	
40, 70, 125 3-pole	27.0	686	20.5	521	12.0	305	31.5	800	82	37	0310-0544
40, 70, 125 4-pole	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0500-4896
150, 225	35.5	902	26.0	660	16.0	406	41.0	1042	165	75	0310-0414
260	43.5	1105	28.5	724	16.0	406	43.0	1093	170	77	0310-0540
300, 400, 600	54.0	1372	25.5	648	18.0	457	42.0	1067	225	102	0310-1307
800, 1000	68.0	1727	30.0	762	20.6	524	48.5	1232	360	163	0310-0417
1000, 1200	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	0310-0482
1600, 2000*	90.0	2290	36.0.	915	48.0	1219	84.0	2134	1100	499	0310-0483
3000*	90.0	2290	36.0	915	48.0	1219	84.0	2134	1250	567	0310-0484
4000*	90.0	2290	46.5	1180	60.0	1520	106	2700	1850	839	0500-4485

Dimensions - transfer switch in UL type 3R, 4 or 12 enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	34.0	864	26.5	673	12.5	318	36.5	927	125	57	3R, 12,	0310-0453
40, 70, 125 4-pole	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0500-4896
											4	0500-4896
150, 225	42.5	1080	30.5	775	16.0	406	44.0	1118	215	97	3R, 12	0310-0454
											4	0310-0446
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	3R, 12	0310-0455
											4	0310-0447
300, 400, 600	59.0	1499	27.5	699	16.5	419	41.5	1054	275	125	3R, 12	0310-1315
											4	0310-1316
800, 1000	73.5	1867	32.5	826	20.8	529	49.5	1257	410	186	3R, 12	0310-0457
											4	0310-0449
1000, 1200	76.3	1937	36.0	915	22.7	577	54.0	1372	450	204	3R, 12, 4	0310-0482
1600, 2000*	90.0	2290	35.5	826	50.9	1293	80.0	2032	1100	499	3R, 12, 4	0310-0744
3000*	90.0	2290	38.0	965	51.0	1295	84.5	2146	1250	567	3R	0310-0745
4000*	90.0	2290	49.0	1244	60.0	1524	105	2654	1850	839	3R	0500-4486

Dimensions - transfer switch in UL type 4X stainless steel enclosure

Amp rating	Height		Width		Depth				Weight		Cabinet type	Outline drawing
					Door closed		Door open					
	in	mm	in	mm	in	mm	in	mm	lb	kg		
40, 70, 125 3-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
40, 70, 125 4-pole	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4896
150, 225	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
260	46.0	1168	32.0	813	16.0	406	46.0	1168	255	102	4X	0500-4184
300, 400, 600	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
800, 1000	73.5	1867	32.5	826	19.5	495	49.5	1257	410	186	4X	0500-4185
1000, 1200	70.0	1778	40.0	1016	19.8	502	59.0	1499	450	204	4X	0306-5300
1600,2000	90.0	2290	35.5	826	50.9	1293	80.0	2032	1100	499	4X	0310-0744

* Rear or side access is required to complete power wiring installations.

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Submittal detail – options (accessories specification sheet AC-167)

Amperage ratings
- ☐ 40
- ☐ 70
- ☐ 125
- ☐ 150
- ☐ 225
- ☐ 260
- ☐ 300
- ☐ 400
- ☐ 600
- ☐ 800
- ☐ 1000
- ☐ 1200
- ☐ 1600
- ☐ 2000
- ☐ 3000
- ☐ 4000

Voltage ratings
- ☐ R020 120*
- ☐ R038 190
- ☐ R021 208
- ☐ R022 220
- ☐ R023 240
- ☐ R024 380
- ☐ R025 416
- ☐ R035 440
- ☐ R026 480
- ☐ R027 600

* Line to neutral voltage (not available on 1200-1500 amp switches)

Pole configuration
- ☐ A028 Poles - 3 (solid neutral)
- ☐ A029 Poles - 4 (switched neutral)

Frequency
- ☐ A044 60 Hertz
- ☐ A045 50 Hertz

Transfer mode
- ☐ A077 In phase transition (open transition)
- ☐ A078 Delayed transition (programmed transition)
- ☐ A079 Closed transition (available 1000-4000 amps, for closed transition below 1000 amps, see CHPC spec sheet S-1437)

Application
- ☐ A035 Utility to genset
- ☐ A036 Utility to utility
- ☐ A037 Genset to genset

System options
- ☐ A041 Single Phase, 2-wire or 3-wire (not available 1200-4000 amps)
- ☐ A042 Three Phase, 3-wire or 4-wire

Enclosure
- ☐ B001 Type 1: General purpose indoor (similar to IEC type IP30)
- ☐ B002 Type 3R: Intended for outdoor use (dustproof and rainproof) (Similar to IEC type IP34)
- ☐ B003 Type 4: Indoor or outdoor use (watertight) (Similar to IEC type IP65)
- ☐ B004 Open Construction: No enclosure - includes automatic transfer switch and controls
- ☐ B010 Type 12: Indoor use, dust-tight and drip-tight (similar to IEC type IP61)
- ☐ B025 Type 4X: Indoor or outdoor use (watertight) (similar to IEC Type IP65)

Standards
- ☐ A046 UL 1008/CSA certification
- ☐ A064 NFPA 20 compliant (not available 1200-4000 A)
- ☐ A080 Seismic certification

Controls
- ☐ C023 Switch control - level 1
- ☐ C024 Switch control - level 2

Control options
- ☐ M017 Security key - front panel
- ☐ M018 Display - digital
- ☐ M022 Monitoring - load
- ☐ M023 Module - relay
- ☐ M031 Communications - LonWorks Network Communications Module (FTT-10)

Meters
- ☐ D009 Digital bar graph meters

Battery chargers
- ☐ K001 2 A, 12/24 V
- ☐ KB59 15 A, 12 V
- ☐ KB60 12 A, 24 V

Protective relays
- ☐ M036 62PL relay
- ☐ M038 86 Lock-out relay

Auxiliary relays - Relays are UL Listed and factory installed. All relays provide (2) normally open and (2) normally closed isolated contacts rated 10 A @ 600 VAC. Relay terminals accept (1) 18 gauge to (2) 12 gauge wires per terminal.
- ☐ L101 24 VDC coil - installed, not wired (for customer use).
- ☐ L102 24 VDC coil - emergency position - relay energized when ATS in source 2 (emergency) position.
- ☐ L103 24 VDC coil - normal position - relay energized when ATS in source 1 (normal) position
- ☐ L201 12 VDC coil - installed, not wired
- ☐ L202 12 VDC coil - emergency position - relay energized when ATS in source 2 (emergency) position
- ☐ L203 12 VDC coil - normal position - relay energized when ATS in source 1 (normal) position

Miscellaneous options
- ☐ M003 Terminal block - 30 points (not wired)
- ☐ M007 Load shed - from emergency - drives switch to neutral position when remote signal contact closes
- ☐ N009 Power connect - bus stabs (150-1200 amp open construction only)
- ☐ N013 Extension harness

Optional lug kits
- ☐ N008 Terminal lugs - cable (1600-3000 amps only)
- ☐ N020 Terminal block - retransfer inhibit

Warranty
- ☐ G002 One year basic
- ☐ G004 Two year comprehensive
- ☐ G006 Five year basic
- ☐ G007 Five year comprehensive
- ☐ G008 Ten year major components

Shipping
- ☐ A051 Packing - export box

Cummins Power Generation

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

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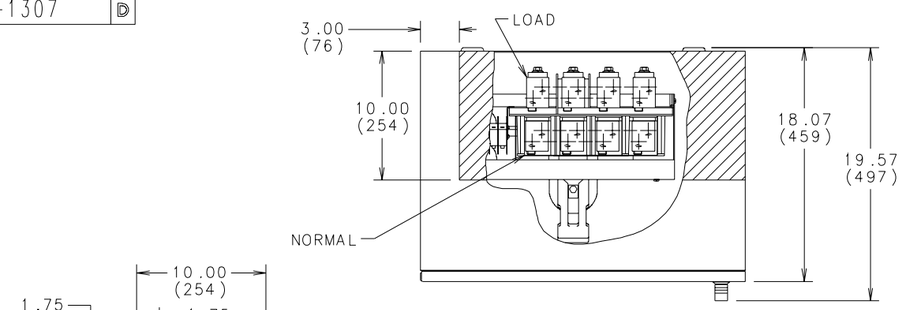
S-1270z (7/08)

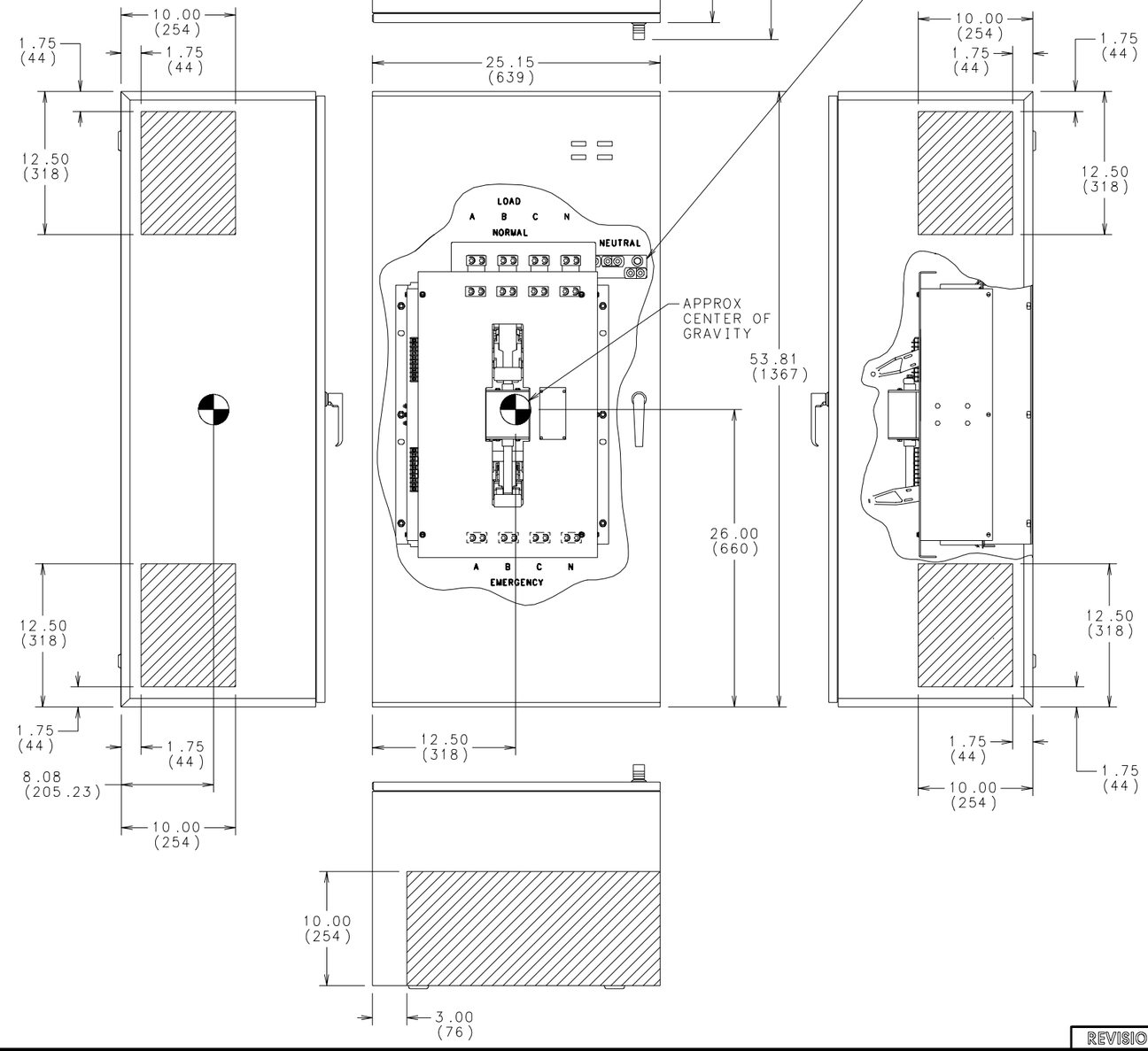
Power Generation

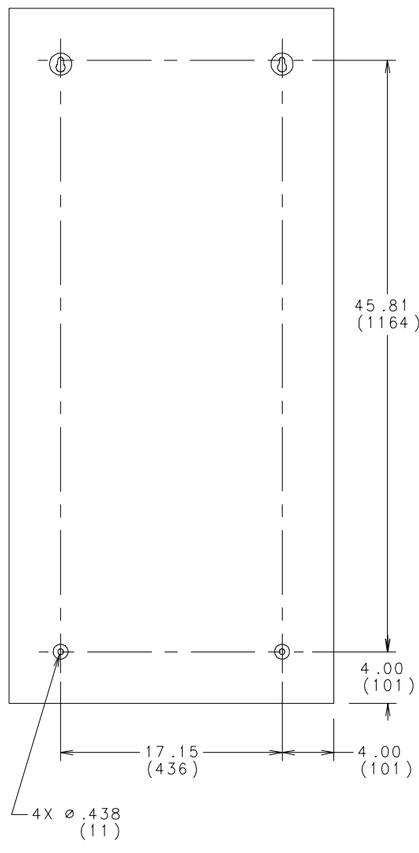
0310-1307 D

ER NO.	LTR	NO.	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD1608	A	1	PRODUCTION RELEASE	-	LK	LHS	L.SWITH	05-19-99
FRD5274	B	1	WAS 4-250 (120) MCM CU-AL QTY 1	2-C	DD	LHS	L.SWITH	04-13-00
FRD1737T	C	1	DIM 18.07 (459) WAS 18.07 (499)	4-D	RWM	BG	L.SWITH	08-05-03
		2	DIM 19.57 (497) WAS 19.57 (459)	4-D	RWM	BG	L.SWITH	08-05-03



SOLID NEUTRAL BAR SUPPLIED WITH 3 POLE MODELS ONLY.





NOTES:

1. UL TYPE 1 ENCLOSURE
2. APPROX. WEIGHT: 225 LBS
   MASS: 102 kg
3. DIMENSIONS IN ( ) ARE MILLIMETRES.
4. LUG CAPACITY: 300, 400 AMP
   (QUANTITY 1 WIRE) 3/0-600 (95-300) MCM CU-AL
   (QUANTITY 2 WIRES) 3/0-250 (25-120) MCM CU-AL
   LUG CAPACITY: 600 AMP
   (QUANTITY 2 WIRES) 250-500 (120-240) MCM CU-AL.
5. USE SEPARATE CONDUITS FOR CONTROL WIRING AND POWER WIRING. DO NOT COMBINE.
6. SHADED AREA INDICATES WIRING AND CABLE ENTRANCE AREA DO NOT INSTALL OUTSIDE OF SHADED AREA.
7. WIRE BENDING SPACE CONFORMS TO NEC TABLE 373-6 (B).
8. REFER TO NATIONAL ELECTRIC CODE, ARTICLE 110-16 WHICH STATES THE REQUIREMENT FOR THE MINIMUM CLEAR SPACE IN FRONT OF THIS UNIT.
9. 4 POLE SWITCHED NEUTRAL TRANSFER SWITCH SHOWN. A SOLID NEUTRAL BAR IS PROVIDED WITH 3 POLE TRANSFER SWITCHES.

3 AND 4 POLE

REVISIO DWG

QTY	ITEM	PART NO.	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

mm		Inch	
X	±	.X	±
.X	±	.XX	±
.XX	±	.XXX	±

FRACTIONS		DECIMALS	
0.00-4.99	±0.25/-0.00	.000-.200	+.000/-.003
5.00-9.99	±0.25/-0.13	.201-.431	+.008/-.004
10.00-17.49	±0.25/-0.13	.432-.782	+.010/-.005
17.50-24.99	±0.38/-0.13	.784-.999	+.012/-.005

ANG TOL ±

DRAWN TO SCALE OF 3/16

SW ID

COPIED FROM 0310-0416 D

THIRD ANGLE PROJECTION

	NAME	DATE
DR	L. KAPLAN	05-18-99
CHKR ☒ MFG ☐	L. SMITH	05-18-99
APPROVED	L. SMITH	05-18-99

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON OTPC 300-600A

Onan

MINNEAPOLIS, MINNESOTA 55432

TITLE OUTLINE-CONTROL BOX

DWG NO. 0310-1307

SHEET 1 of 1

DWG SIZE D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

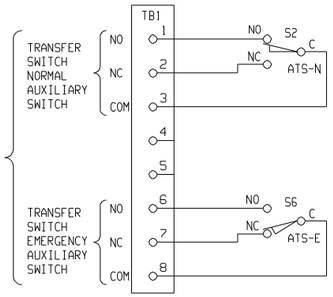
CUSTOMER CONNECTIONS

AUXILIARY CONTACTS

MOUNTED ON FRONT OF TRANSFER SWITCH. AVAILABLE ON ALL UNITS.

FOR CUSTOMER USE

TRANSFER SWITCH AUXILIARY CONTACTS RATED: 10 AMPS, 250 VAC



UTILITY TO GENERATOR

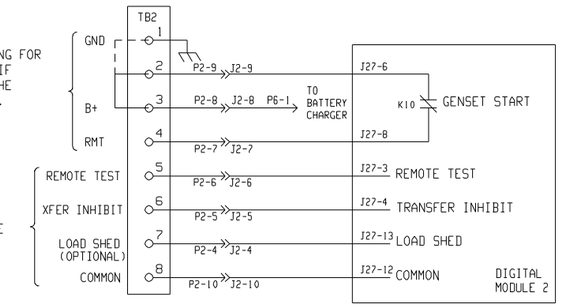
TO ENGINE GENERATOR CONTROL

REFER TO THE INTERCONNECTION DRAWING FOR PROPER INSTALLATION OF WIRING AND IF NEEDED, JUMPER LOCATION, BETWEEN THE GENSET CONTROL AND TRANSFER SWITCH.

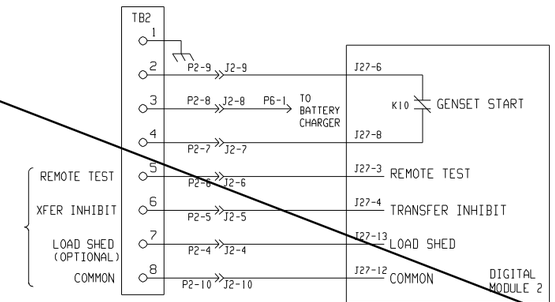
ON PARALLELING SYSTEMS. REFER TO SYSTEM INTERCONNECTION DRAWING FOR CORRECT WIRING.

FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.



UTILITY TO UTILITY

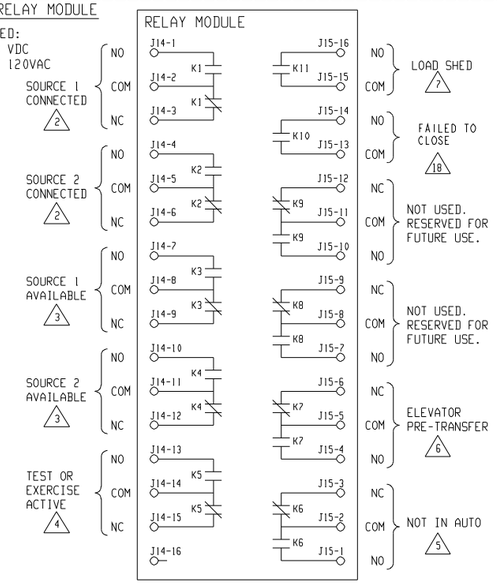


FOR CUSTOMER USE

TO USE REMOTE TEST, TRANSFER INHIBIT AND LOAD SHED CONNECT AN OPEN CONTACT BETWEEN THE APPLICABLE TERMINAL AND COMMON (TB2-8). CLOSE THE CONTACT TO ACTIVATE THE FUNCTION. NOTE THAT LOAD SHED IS OPTIONAL AND MUST BE INSTALLED IN ORDER TO USE.

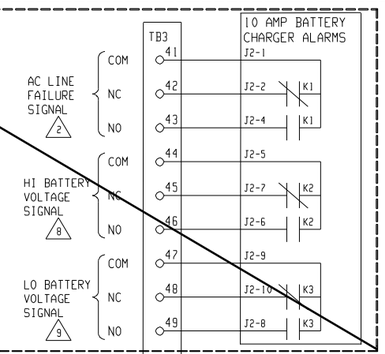
OPTIONAL: RELAY MODULE

CONTACTS RATED:
2 AMPS AT 30 VDC
0.60 AMPS AT 120VAC



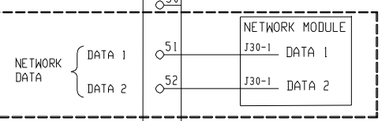
OPTIONAL: 10 AMP BATTERY CHARGER ALARMS

CONTACTS RATED:
4 AMPS AT 30 VDC OR 120VAC MAX



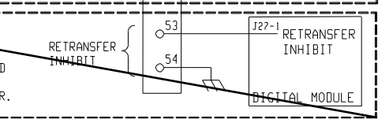
OPTIONAL: NETWORK MODULE

USE TWISTED PAIR



OPTIONAL: RETRANSFER INHIBIT

CONNECT A JUMPER OR A CLOSED CONTACT BETWEEN TB3-53 AND TB3-54 TO INHIBIT RETRANSFER.



REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	ADD NOTE 18	B-2	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	ADDED OPTIONAL BATTERY CHARGER	3B	SDM	IAM	MILLER	11-26-04
		2	ADDED NOTES 19 & 20	2B	SDM	IAM	MILLER	11-26-04

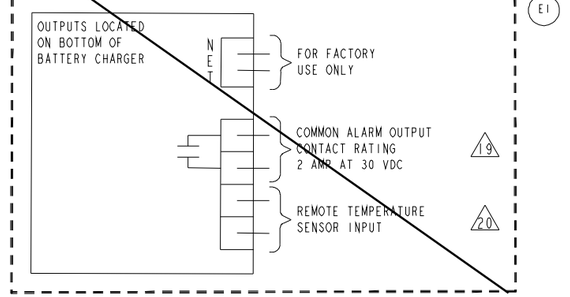
NOTES:

1. TB1 AND TB2 ARE MOUNTED ON THE FRONT OF THE TRANSFER SWITCH. TB3 IS MOUNTED ON THE LEFT INSIDE PANEL OF THE ENCLOSURE.
2. SHOWN WITH SOURCE NOT CONNECTED.
3. SHOWN WITH SOURCE NOT AVAILABLE.
4. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING TEST OR EXERCISE PERIOD.
5. SHOWN WITH CONTROL IN AUTOMATIC MODE. CONTACTS CHANGE STATE WHEN CONTROL IS NOT IN AUTO.
6. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE FOR AN ADJUSTABLE TIME BEFORE LOAD TRANSFER OCCURS.
7. SHOWN NOT ACTIVE. CONTACTS CHANGE STATE DURING LOAD SHED.
8. SHOWN UNDER NORMAL BATTERY VOLTAGE CONDITION. CONTACTS TRANSFER UNDER A HIGH BATTERY VOLTAGE CONDITION.
9. SHOWN UNDER A LOW BATTERY VOLTAGE CONDITION.
10. SEE SHEET 2.
11. SEE SHEET 2.
12. SEE SHEET 2.
13. SEE SHEET 4.
14. SEE SHEET 4.
15. SEE SHEET 5.
16. SEE SHEET 5.
17. SEE SHEET 5.
18. (D2) SHOWN NOT ACTIVE, CONTACT CHANGES STATE DURING A FAILED TO TRANSFER OR FAILED TO RETRANSFER EVENT.
19. (E2) THE FOLLOWING WILL CAUSE A BATTERY CHARGER ALARM OUTPUT:
    LOW BATTERY VOLTAGE
    HIGH BATTERY VOLTAGE
    LOW AC INPUT VOLTAGE
    HIGH AC INPUT VOLTAGE
    OVERCURRENT
    HIGH CHARGER TEMPERATURE
    BATTERY FAILURE
    HIGH BATTERY TEMPERATURE ; NOT AVAILABLE ON 2 AMP CHARGER
20. USE THE INVENTER REMOTE TEMPERATURE PROBE. (PART NO. 0193-0530)

LEVEL 2 CONTROL
DISPLAY MODULE
3 AND 4 POLE
40-600 AMP
120 VOLT 1 PHASE L-N
240 VOLT 1 PHASE
190 VOLT 3 PHASE
208 VOLT 3 PHASE
220 VOLT 3 PHASE
240 VOLT 3 PHASE
380 VOLT 3 PHASE
415 VOLT 3 PHASE
440 VOLT 3 PHASE
480 VOLT 3 PHASE

OPTIONS:
NETWORK MODULE
LOAD SHED
RELAY MODULE
BAR GRAPH
LOAD CURRENT MODULE
BATTERY CHARGER
BATTERY CHARGER ALARMS
RETRANSFER INHIBIT

OPTIONAL: BATTERY CHARGER ALARM 2 AMP, 12 AMP, 15 AMP

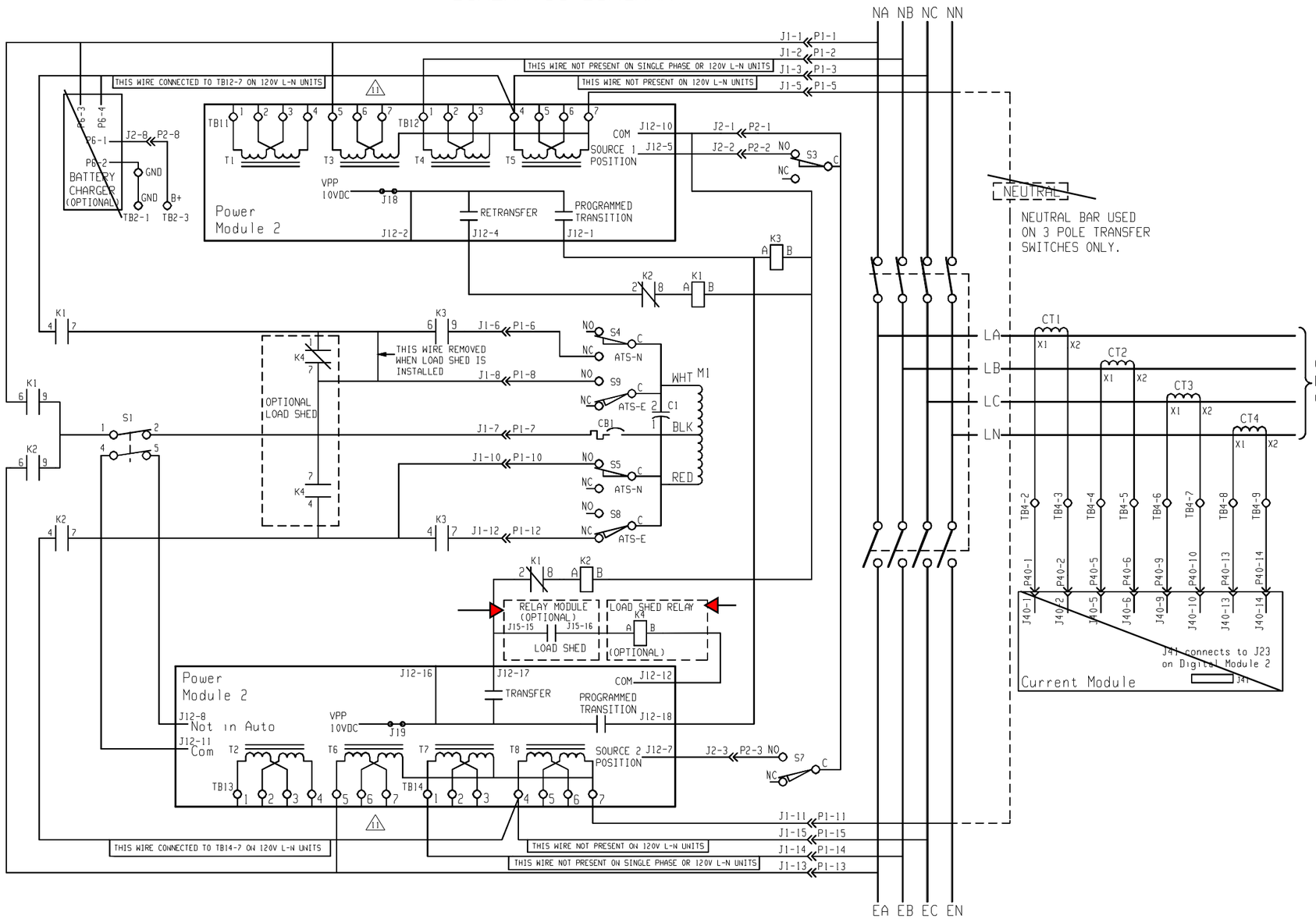


DO NOT SCALE PRINT	TOLERANCE UNLESS OTHERWISE SPECIFIED				SIM TO	ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	NOT REQ
	DIM	mm	inch		COPIED FROM					
		X ± 1	.X ±							
		.X ± 1	.XX ±		THIRD ANGLE PROJECTION					
ANG TOL± 1°		.XX ± 1	.XXX±				NAME	DATE	CUMMINS	CUMMINS POWER GENERATION
	HOLE	0.99- 4.99 +0.15/-0.08	.004-.200 +.006/-.003			DR	S D MORE	11/26/04		1400 73RD AVE NE MINNEAPOLIS, MINNESOTA 55432
DRAWN TO SCALE OF 1/1		5.00- 9.99 +0.20/-0.10	.201-.421 +.008/-.004			CHKR ED MFG	I A MAHADESHWAR	11/26/04		
		10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005			APPROVED	MILLER	11/26/04	SITE CODE	TITLE: WD-TRANSFER SWITCH
		17.50-24.99 +0.30/-0.13	.704-.999 +.012/-.005		THIS DOCUMENT IS THE PROPERTY OF CUMMINS POWER GENERATION. IT CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION WHICH MUST NOT BE DUPLICATED, USED OR DISCLOSED OTHER THAN EXPRESSLY AUTHORIZED BY CUMMINS POWER GENERATION OR ITS REPRESENTATIVE	FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982	MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC		PGA	DRG NO 0626_2311	SHEET 1 of 5	DRG SIZE D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

SCHEMATIC DIAGRAM



K3 PROGRAMMED TRANSITION RELAY

K1 TRANSFER TO NORMAL RELAY

M1 LINEAR MOTOR

C1 MOTOR RUN CAPACITOR

CB1 CIRCUIT BREAKER

S1 LINEAR MOTOR DISABLE

K2 TRANSFER TO EMERGENCY RELAY

K4 LOAD SHED RELAY

NOTES:

10. ALL DEVICES ARE SHOWN DE-ENERGIZED, WITH THE TRANSFER SWITCH CLOSED TO NORMAL. 4 POLE TRANSFER SWITCH SHOWN. ON 3 POLE MODELS THE SWITCHED NEUTRAL POLE IS REPLACED WITH A SOLID NEUTRAL BAR.

11. SEE SHEET 3 FOR TRANSFORMER PRIMARY JUMPERS.

12. FOR SINGLE PHASE UNITS:
120/240, 3 WIRE - CONNECT POWER CABLES TO A AND C
120 L-N, 2 WIRE - CONNECT POWER CABLES TO A AND NEUTRAL

DO NOT SCALE PRINT

ANG TOL± 1°

DRAWN TO SCALE OF 1/1

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±
MALE	0.00-4.99 ±0.15/-0.08	.004-.200 +.006/-.003
	5.00-9.99 ±0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 ±0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 ±0.30/-0.13	.704-.999 +.012/-.005

ITEM	PART NO	QNG SITE	DESCRIPTION OR MATERIAL	REF DES

	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

SIM TO .
COPIED FROM .
THIRD ANGLE PROJECTION

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FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

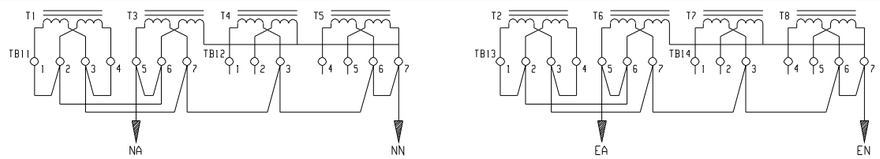
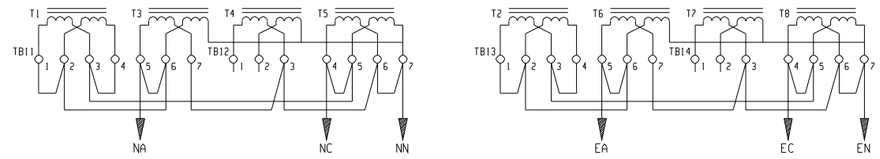
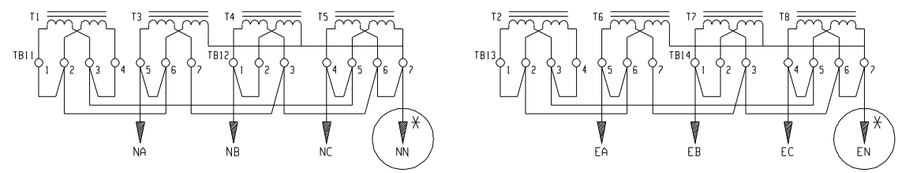
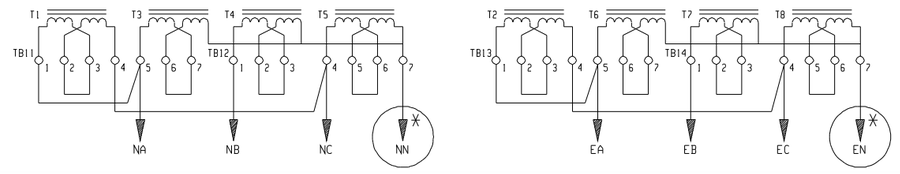
DRG NO: 0626_2311

SHEET: 2 OF 5

DRG SIZE: D

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	RMVD NOTE 2 DELTA JUMPER WIRE	C-1	JM	LHS	LHS	10-22-02
		4	RMVD NOTE DO NOT ADD DELTA WIRE	C-1	JM	LHS	LHS	10-22-02
		5	EC WAS EB	B-3	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

POWER MODULE 2 FACTORY TRANSFORMER CONNECTIONS

LINE TO LINE VOLTAGE	
120 VAC L-N 2 WIRE	
240 VAC 1 PHASE 3 WIRE	
190-240 VAC 3 PHASE 4 WIRE	
380-480 VAC 3 PHASE 4 WIRE	

SEE 0626-2312 FOR 600 VOLT CONNECTIONS.

*CONNECTIONS FOR SPECIAL WYE AND DELTA APPLICATIONS

APPLICATION	POWER MODULE WIRING CHANGES
4-WIRE, 3-PHASE WYE WITH GROUNDED NEUTRAL	NO WIRING CHANGES NECESSARY THIS IS THE FACTORY CONFIGURATION
3-WIRE, 3-PHASE DELTA OR WYE WITH NO NEUTRAL OR UNGROUNDED NEUTRAL	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.
4-WIRE, 3-PHASE DELTA WITH GROUNDED NEUTRAL OR 3-WIRE, 3 PHASE DELTA WITH A GROUNDED CORNER.	1. DISCONNECT THE NEUTRAL SENSING WIRES FROM TB12-7 & TB14-7 ON THE POWER MODULE.

(D3) (D4) (D5)

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	NOT REQ

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±

HOLE			
ANG TOL± 1°	0.99- 4.99	±0.15/-0.08	.004-.200	+.006/-.003
DRAWN TO SCALE OF 1/1	5.00- 9.99	±0.20/-0.10	.201-.421	+.008/-.004
	10.00-17.49	±0.25/-0.13	.422-.703	+.010/-.005
	17.50-24.99	±0.30/-0.13	.704-.999	+.012/-.005

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THIRD ANGLE PROJECTION

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ED MFG	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

DRG NO: 0626_2311

SHEET: 3 of 5

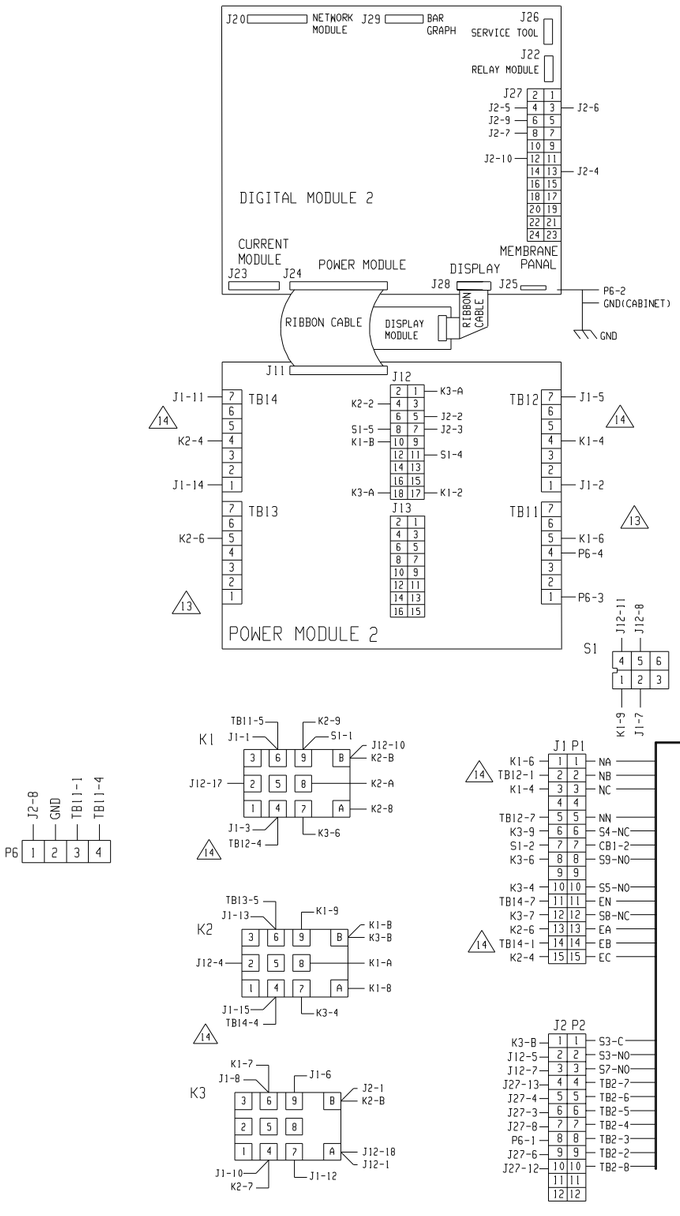
DRG SIZE: D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

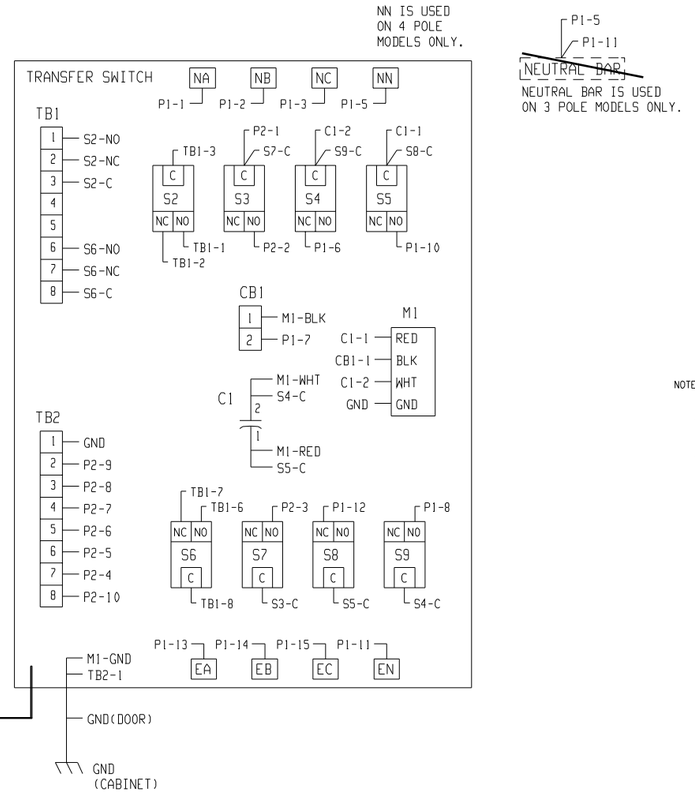
STANDARD WIRING

REAR VIEW OF DOOR



LEFT SIDEWALL

REAR WALL OF CABINET



NEUTRAL BAR IS USED ON 3 POLE MODELS ONLY.

NOTES:

13. SEE SHEET 3 FOR TB11, TB12, TB13 AND TB14 JUMPER CONNECTIONS.

14. ON ALL SINGLE PHASE, 2 OR 3-WIRE UNITS: THE WIRES CONNECTED FROM J1-2 TO TB12-1 AND FROM J1-14 TO TB14-1 ARE NOT PRESENT.

IN ADDITION, ON 120 VOLT L-N, 2-WIRE UNITS: THE WIRES CONNECTED FROM J1-3 TO K1-4 AND FROM J1-15 TO K2-4 ARE NOT PRESENT. THE WIRE CONNECTED FROM K1-4 TO TB12-4 WILL BE CONNECTED FROM K1-4 TO TB12-7 AND THE WIRE CONNECTED FROM K2-4 TO TB14-4 WILL BE CONNECTED FROM K2-4 TO TB14-7.

ITEM	PART NO	DWG SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

ANG TOL± 1°

DRAWN TO SCALE OF 1/1

TOLERANCE UNLESS OTHERWISE SPECIFIED	mm	inch
DIM	X ± 1 .X ± 1 .XX ± 1	.X ± .XX ± .XXX±
HOLE	0.00-4.99 ±0.15/-0.38 5.00-9.99 ±0.20/-0.10 10.00-17.49 ±0.25/-0.13 17.50-24.99 ±0.30/-0.13	.004-.200 +.006/-.003 .201-.421 +.008/-.004 .422-.783 +.010/-.005 .784-.999 +.012/-.005

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A 120-480 VAC

SPEC A

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD-TRANSFER SWITCH

DWG NO: 0626_2311

SHEET 4 of 5

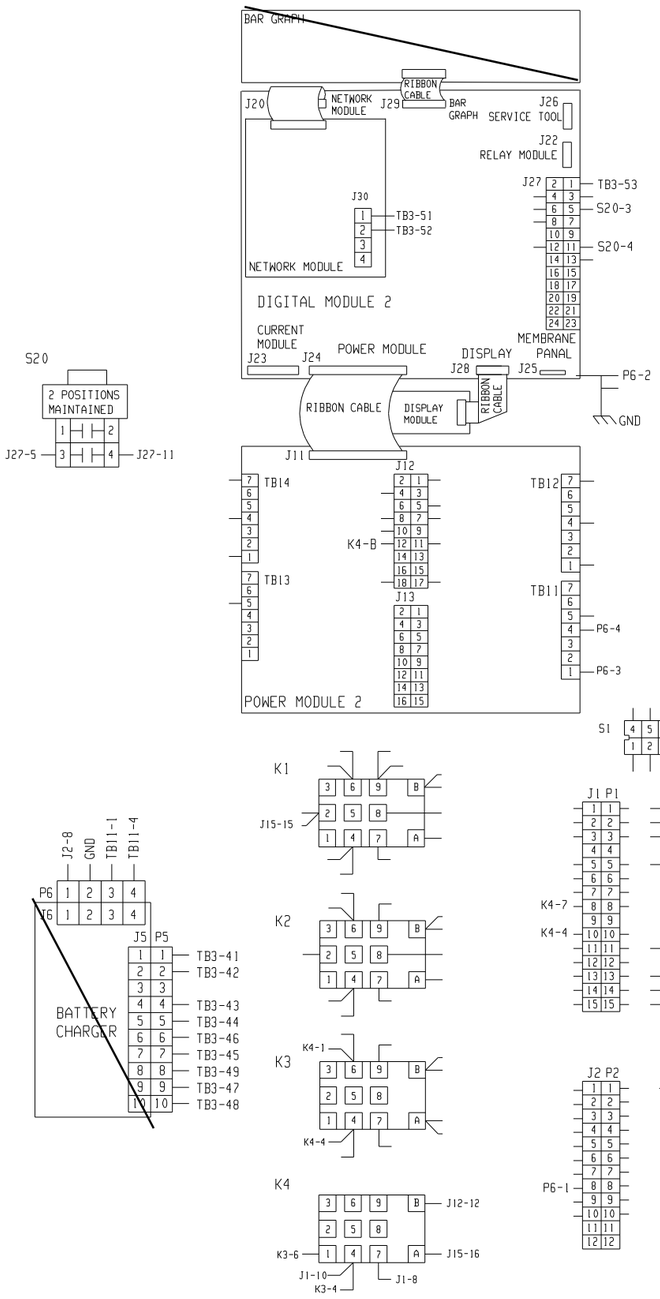
DWG SIZE: D

0626_2311	D	Pro/ENGINEER	2D ONLY DWG

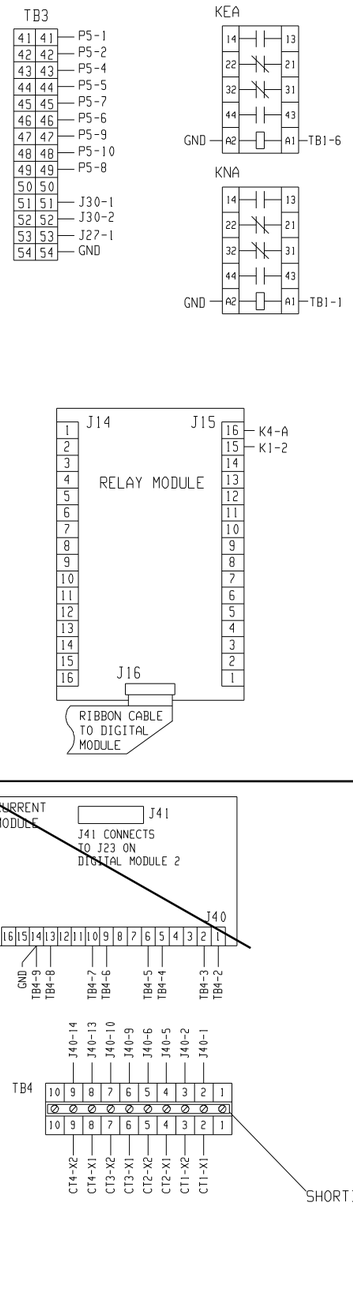
OPTION WIRING

REL NO	LTR	NO	REVISION	ZONE	DR	CHKR	APPROVED	DATE
FRD8642	D	1	RECREATED IN PRO-E	-	JM	LHS	LHS	10-22-02
		2	SEE SHEET 1	-	JM	LHS	LHS	10-22-02
		3	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		4	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
		5	SEE SHEET 3	-	JM	LHS	LHS	10-22-02
FRD21067	E	1	SEE SHEET 1	-	SDM	IAM	MILLER	11-26-04

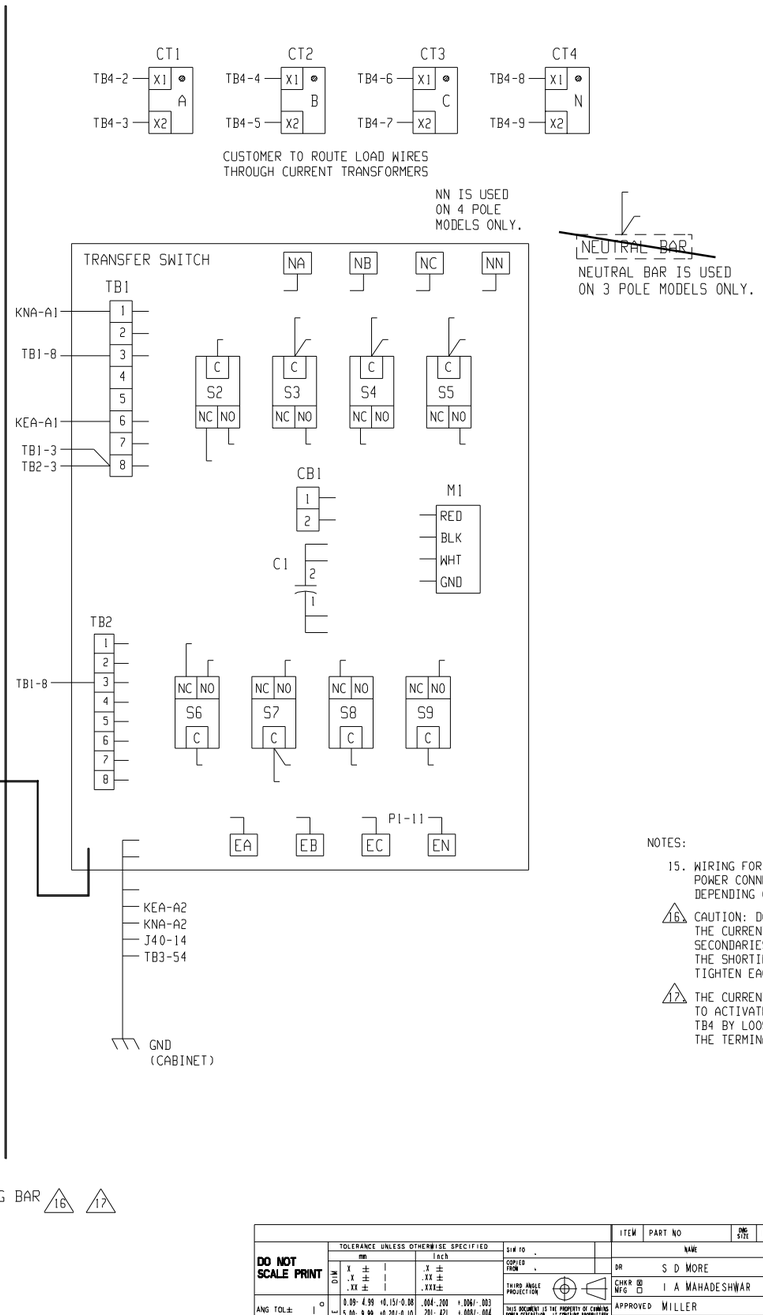
REAR VIEW OF DOOR



LEFT SIDEWALL



REAR WALL OF CABINET



NOTES:

15. WIRING FOR RELAYS KNA AND KEA IS TYPICAL. POWER CONNECTIONS TO COILS MAY VARY SLIGHTLY DEPENDING ON THE NUMBER OF RELAYS INSTALLED.

16. CAUTION: DO NOT DISCONNECT THE CURRENT MODULE WHILE THE CURRENT TRANSFORMERS ARE ENERGIZED UNLESS THE SECONDARIES ARE SHORTED. TO SHORT SECONDARIES ATTACH THE SHORTING BAR TO THE CENTER OF TB4 BEING SURE TO TIGHTEN EACH SCREW.

17. THE CURRENT TRANSFORMERS ARE SHORTED DURING SHIPPING. TO ACTIVATE, REMOVE THE SHORTING BAR FROM THE CENTER OF TB4 BY LOOSENING ALL OF THE SCREWS AND LIFTING IT OUT OF THE TERMINAL BLOCK. SAVE FOR REUSE.

ITEM	PART NO	QNTY SIZE	DESCRIPTION OR MATERIAL	REF DES

DO NOT SCALE PRINT

TOLERANCE UNLESS OTHERWISE SPECIFIED

DIM	mm	inch
	X ± 1	.X ±
	.X ± 1	.XX ±
	.XX ± 1	.XXX ±
ANG TOL ±	1°	
HOLE	0.89-4.99 +0.15/-0.08	.004-.200 +.006/-.003
	5.00-9.99 +0.20/-0.10	.201-.421 +.008/-.004
	10.00-17.49 +0.25/-0.13	.422-.703 +.010/-.005
	17.50-24.99 +0.38/-0.13	.704-.999 +.0127-.005

DRAWN TO SCALE OF 1/1

SIM TO

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	NAME	DATE
DR	S D MORE	11/26/04
CHKR ☒ MFG ☐	I A MAHADESHWAR	11/26/04
APPROVED	MILLER	11/26/04

FOR INTERPRETATION OF DIMENSIONING AND TOLERANCING, SEE ANSI Y14.5M-1982

MODEL FIRST USED ON: OTPC 40-600A SPEC A 120-480 VAC

SITE CODE: PGA

CUMMINS POWER GENERATION
1400 73RD AVE NE
MINNEAPOLIS, MINNESOTA 55432

TITLE: WD_TRANSFER SWITCH

DRG NO: 0626_2311

SHEET: 5 of 5

DRG SIZE: D

PART	QTY	DESCRIPTION
1	3	INTAKE LOUVER WITH 1/2"x1/2" 16Ga. BIRDSCREEN
2	–	INTAKE BAFFLE SILENCER
3	1	REMOVABLE INTAKE HOOD
4	1	10" EXHAUST RAINCAP
5	1	10" EXHAUST ELBOW w/PIPE EXTENSION
6	2	EXHAUST SUPPORT CHANNELS
7	1	10" SUPER CRITICAL EXHAUST SILENCER
8	1	HIGH TEMPERATURE REMOVABLE BLANKET
9	1	EXHAUST FLEX w/HIGH TEMPERATURE REMOVABLE BLANKET
10	1	REMOVABLE DISCHARGE HOOD
11	3	DISCHARGE LOUVER WITH 1/2"x1/2" 16Ga. 16Ga. BIRDSCREEN
12	1	DISCHARGE BAFFLE SILENCER
13	1	TURNING VANE
14	1	300 US GALLON UL 142 DOUBLE WALL FUEL TANK
15	3	W6x15 GENSET SUPPORT BEAMS
16	6	SPRING ISOLATORS CALDYN RJSD 2120K 7855
17	6	1/2" ISOLATOR PLATES (10"x7.5")
18	4	LIFT LUGS ON FUEL TANKS FOR ENTIRE UNIT LIFT
19	1	500kW DFEK GENSET
20	3	FLUORESCENT LIGHTS
21	5	DOORS (48"Wx80"H) c/w LEAF HINGES, RECESSED LOCKING HANDLES NEOPRENE GASKET SEAL, DRIP EDGE ABOVE DOORS & DOOR HOLDS
22	1	OIL DRAIN TO EXTERIOR c/w BALL VALVE
23	1	BATTERY CHARGER
24	1	COOLANT DRAIN TO EXTERIOR c/w BALL VALVE
25	1	100A 120/208 1ø PANEL WITH BREAKERS FOR APPLIANCES (c/w MOUNTING STAND)
26	1	2 HEAD EMERGENCY LIGHT w/BATTERY
27	2	20A GFI DUPLEX RECEPTACLES
28	2	3 WAY LIGHT SWITCH
29	–	STRUCTURAL STEEL FRAMING AND ENCLOSURE BASE ASSEMBLY
30	1	RACOR FUEL/WATER SEPERATOR

GENERAL NOTES:

PREP AND PAINT:

–CLEAN TO SPEC SSPC–SP1

–PRIMED WITH MACROPOXY PRIMER

–TOP COATED WITH ACROLON 218

–COLOR TBD BY OTHERS

WALLS

–14Ga. GALVANEALLED STEEL

–FULLY INSULATED w/ 4" THICK (4lb) MINERAL WOOL

–2 mil POLY LINER

–LINED w/22Ga. PERFORATED GALVANIZED STEEL SCREWED IN PLACE.

ROOF

–14Ga. GALVANEALLED STEEL

–FULLY INSULATED w/ 4" THICK (4 lb) MINERAL WOOL

–2 mil POLY LINER

–LINED w/22Ga. PERFORATED GALVANIZED STEEL SCREWED IN PLACE.

–ROOF RAFTERS 16" O.C.

–ROOF IS PITCHED 2"

ATTENUATION

–THE SOUND PRESSURE LEVEL SHALL AVERAGE 75dBA AT 23' IN A FREE FIELD CONDITION

ELECTRICAL

–ALL WIRING = > 120 V IS IN EMT CONDUIT

–ALL WIRING = < 24 V IS IN SPLIT LOOM

ITEMS INSTALLED

–INSTALL CUMMINS SUPPLIED 500kW DFEK w/SPRING ISOLATORS & BATTERY CHARGER

ITEMS SHIPPED LOOSE

–INTAKE & DISCHARGE HOOD ASSEMBLIES PREFIT & SHIPPED LOOSE FOR INSTALL ON SITE BY OTHERS.

WEIGHT

–APPROX. 30,000 lbs dry.

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DWN. BY: DS
DATE: 2/9/09
CHK. BY: –
DATE: –
APP. BY: –
DATE: –
JOB NUMBER: – – – –

IBI TANKS & INDUSTRIAL FABRICATION
20394 PINTO LANE, CALDWELL ID. 83605
P.O. BOX 1243, 83606 PH. 208–459–6077
FAX: 208–459–9320 1–800–497–8251
Email: engineering@ibitanks.com | WWW.IBITANKS.COM

Description: BILL OF MATERIALS
Customer: CUMMINS NORTHWEST
Customer Project Name: COWPERWOOD
Customer Project Number: TBD

SCALE:	DRAWING NO.	SHT.	REV.
1/8"=1'–0"	9–01–127	1/4	ID

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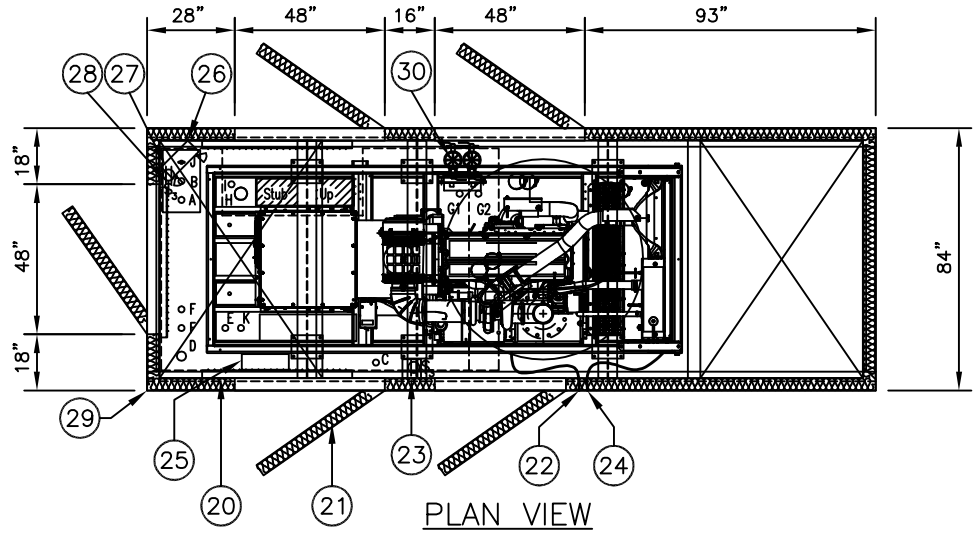
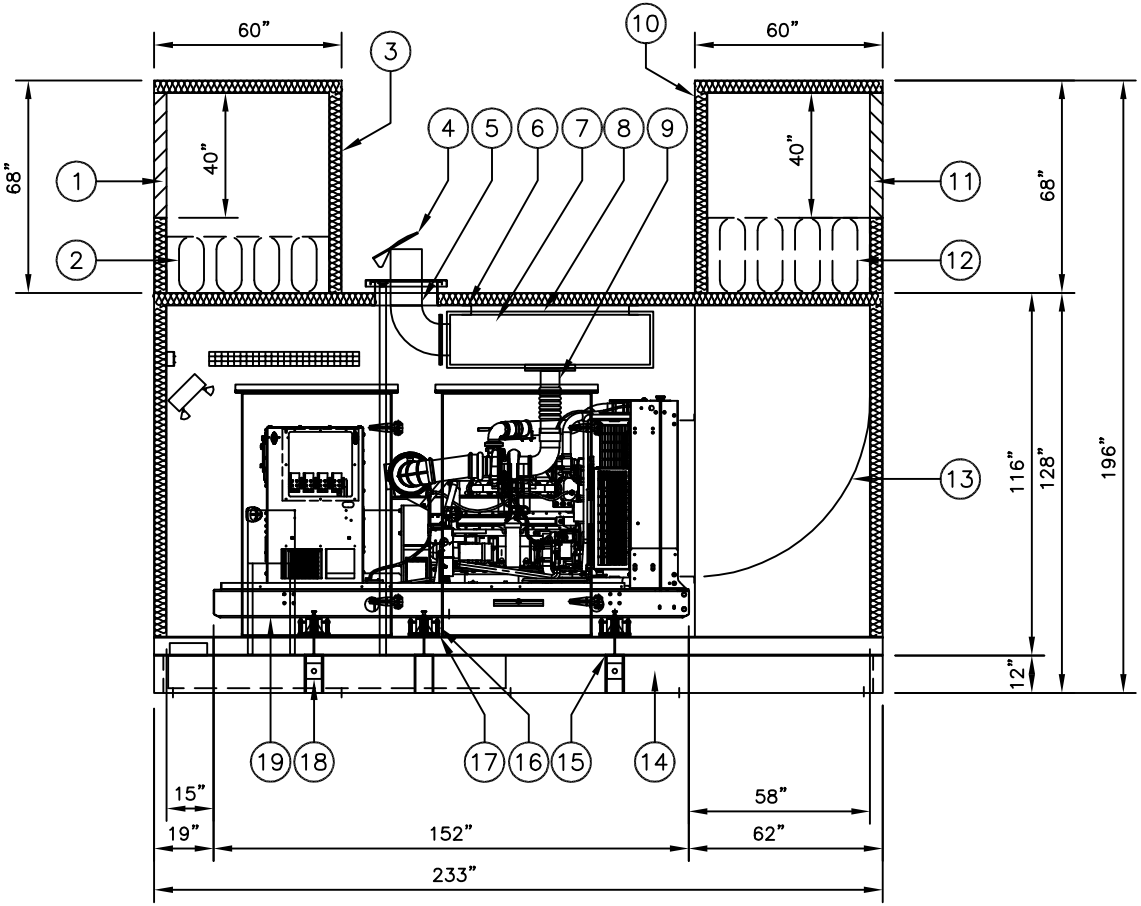
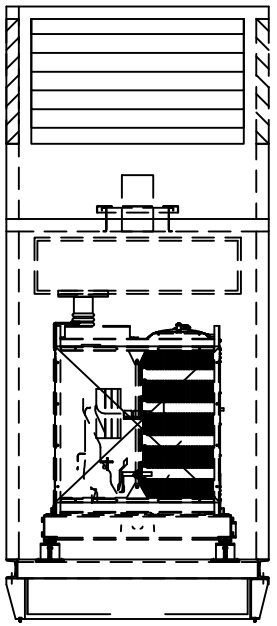


PLAN VIEW



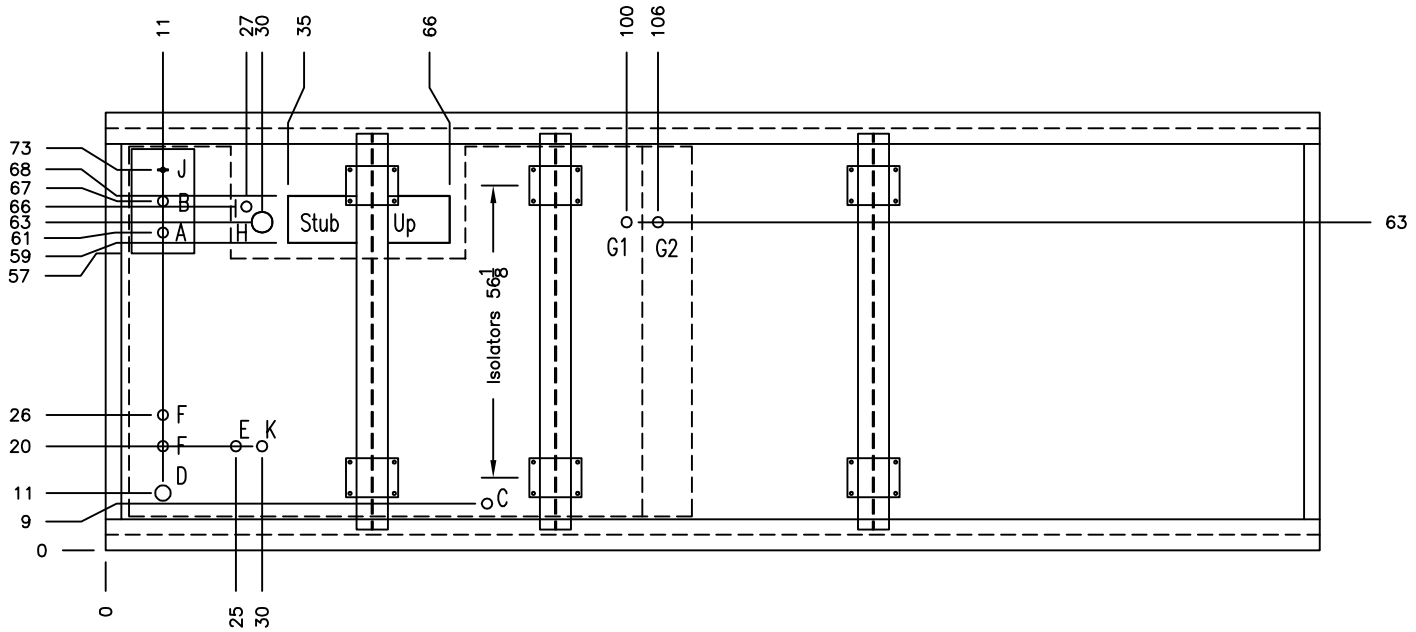
ELEVATION VIEW

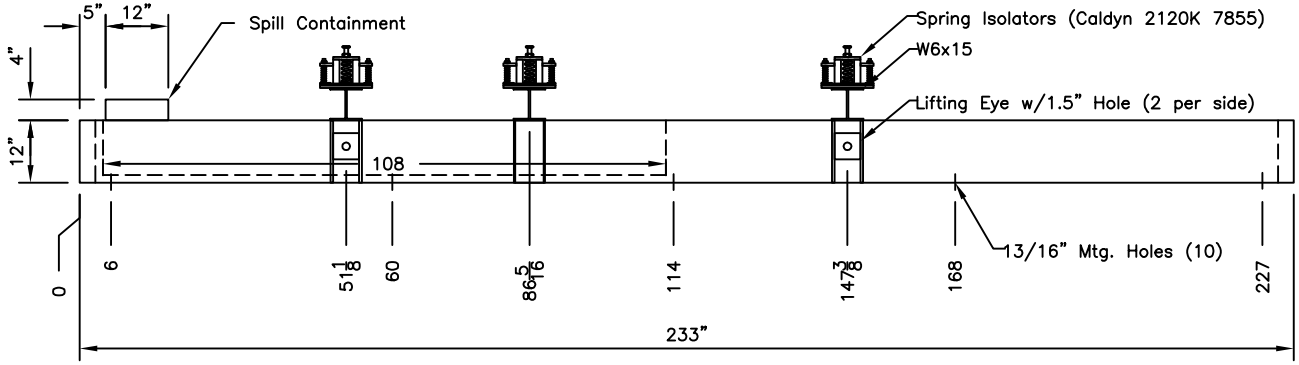


FRONT VIEW

DWN. BY: DS	TANKS & INDUSTRIAL FABRICATION 20394 PINTO LANE, CALDWELL ID. 83605 P.O. BOX 1243, 83606 PH. 208-459-6077 FAX: 208-459-9320 1-800-497-8251		
DATE: 2/9/09	Email: engineering@ibitanks.com	WWW.IBITANKS.COM	
CHK. BY: –	Description: GENERAL ARRANGEMENT		
DATE: –	Customer: CUMMINS NORTHWEST		
APP. BY: –	Customer Project Name: COWPERWOOD		
DATE: –	Customer Project Number: TBD		
JOB NUMBER: – – – –	SCALE: 3/16"=1'-0"	DRAWING NO. 9-02-127	SHT. 2/4 REV. ID

All Dimensions Nominal.





Fitting List

A	2" MANUAL FILL w/Locking Cap
B	2" Mechanical fuel gauge
C	2" Normal Vent (Ext. 12' AFG)
D	3" Primary E Vent 28,600 CFH
E	2" 85% High & 30% Low alarm
F	2" Extra (PLUGGED)
G1	2" x 1" Engine Supply w/drop tube
G2	2" x 1" Engine Return w/drop tube
H	4" Secondary E Vent 52,900 CFH
I	2" Leak Detect
J	1/2" Drain back to main tank w/"T" Handle
K	2" 90% Critical High

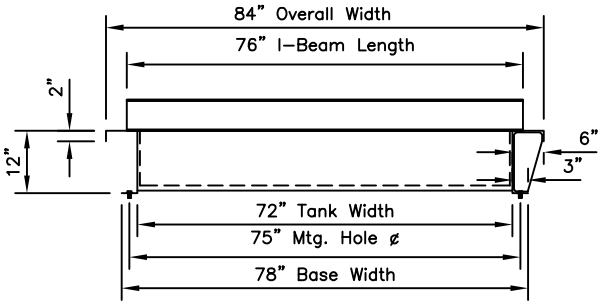
Notes & Comments

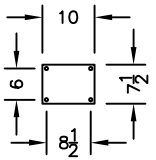
High Alarm & Leak Detect set NOFD. Low Alarm set NCFD.
Painted Black.

As Drawn: Actual gallons 305
useable gallons 276

Dry Weight: 3,900 lbs

MH 26349
UL Listed UL 142





ISOLATOR PLATES
6 REQ'D
CALDYN RJSD 2120K 7855

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DATE:	2/9/09
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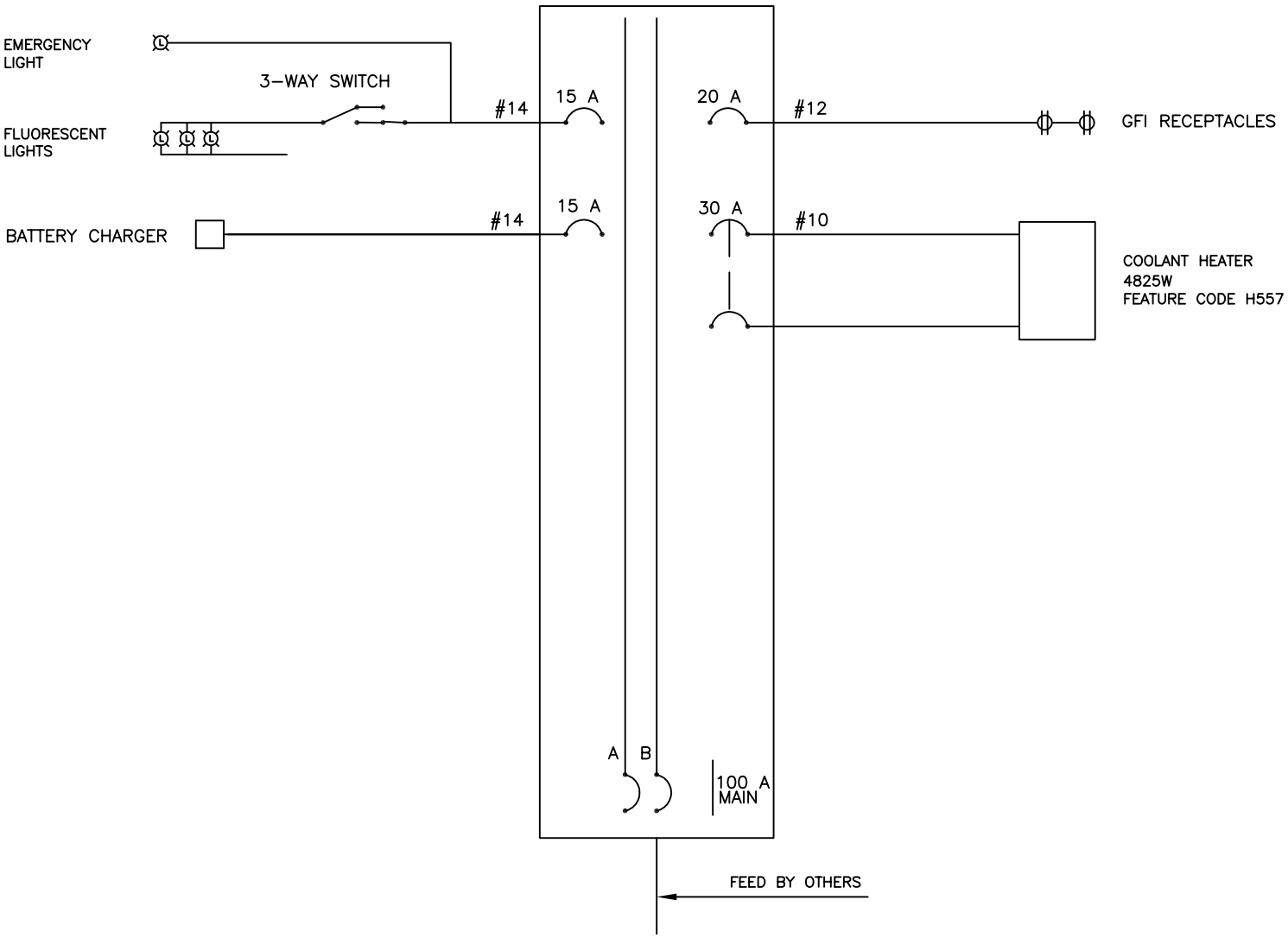
DATE:	–
APP. BY	–
DATE:	–
JOB NUMBER:	----

TANKS & INDUSTRIAL FABRICATION
20394 PINTO LANE, CALDWELL ID. 83605
P.O. BOX 1243, 83606 PH. 208-459-6077
FAX: 208-459-9320 1-800-497-8251
Email: engineering@ibitanks.com | WWW.IBITANKS.COM

Description: 300 GALLON FUEL TANK
Customer: CUMMINS NORTHWEST
Customer Project Name: COWPERWOOD
Customer Project Number: TBD

SCALE:	DRAWING NO.	SHT.	REV.
5/16"=1'-0"	9-03-127	3/4	ID



120/208V, 1ø, 100A 20 CIRCUIT
ALL WIRING IS IN SURFACE MOUNT EMT CONDUIT

100A 120/208 1ø PANEL

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DATE:	2/9/09
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DATE:	–
JOB NUMBER:	– – – –

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P.O. BOX 1243, 83606 PH. 208-459-6077
FAX: 208-459-9320 1-800-497-8251
Email: engineering@ibitanks.com | WWW.IBITANKS.COM

Description: ELECTRICAL SCHEMATIC
Customer: CUMMINS NORTHWEST
Customer Project Name: COWPERWOOD
Customer Project Number: TBD

SCALE:	DRAWING NO.	SHT.	REV.
NTS	9-04-127	4/4	ID

Northwest

2-27-09
Battelle BSF/CSF Building Project.

Load Shedding Panel for
Automatic Transfer Switches

Operational Description.

These load additions will be sequenced on by time delays in each transfer switch.

The 3 transfer switches will be added to the generator is specified order:
ATS-1, Priority 1 transfer within 10 seconds
ATS-2, Priority 2 transfer within 60 seconds
ATS-3, Priority 3 transfer within 120 seconds

The transfer switches will be shed from the generator in the following sequence if generator output is exceeded via load shed panel.
ATS-3 Priority 3, will be 1st to shed if generator output is exceeded (time delay range .1 sec to 5 min.)
ATS-2 Priority 2, will be 2nd to shed if generator output is exceeded (time delay range .1sec to 5 min.)
ATS 1 Priority 1, is normally not included in load shedding, but can be included if required.

Watt transducer includes adjustable shed trip point for each transfer switch

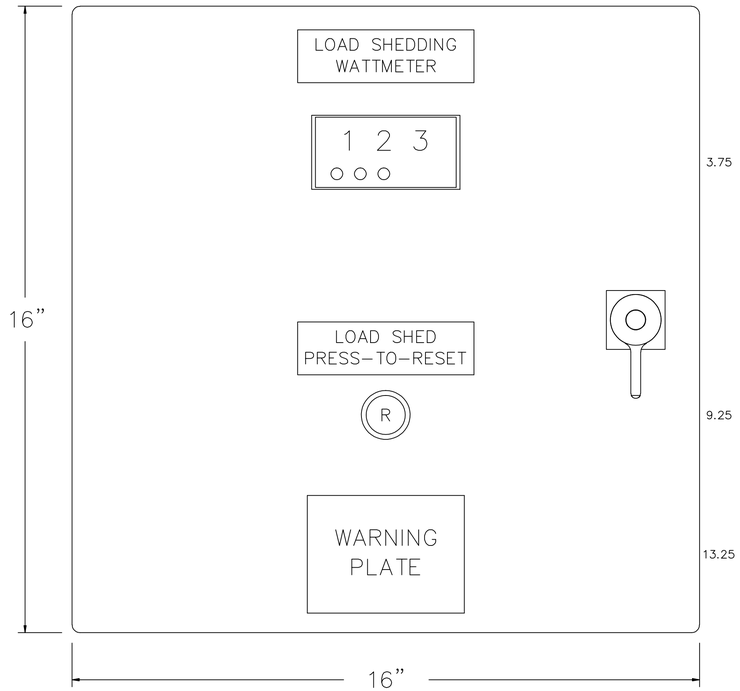
See bill of materials, load shed panel outline drawing and schematic wiring drawing.

Regards,

Greg Reichert

Greg Reichert
Commercial Power Generation Sales
Cummins Northwest, LLC

Cummins Northwest, LLC
11134 West Westbow Bouldevard
Spokane, WA 99224-9475
Phone 509 455 4411
Fax 509 624 4681
cumminsnorthwest.com



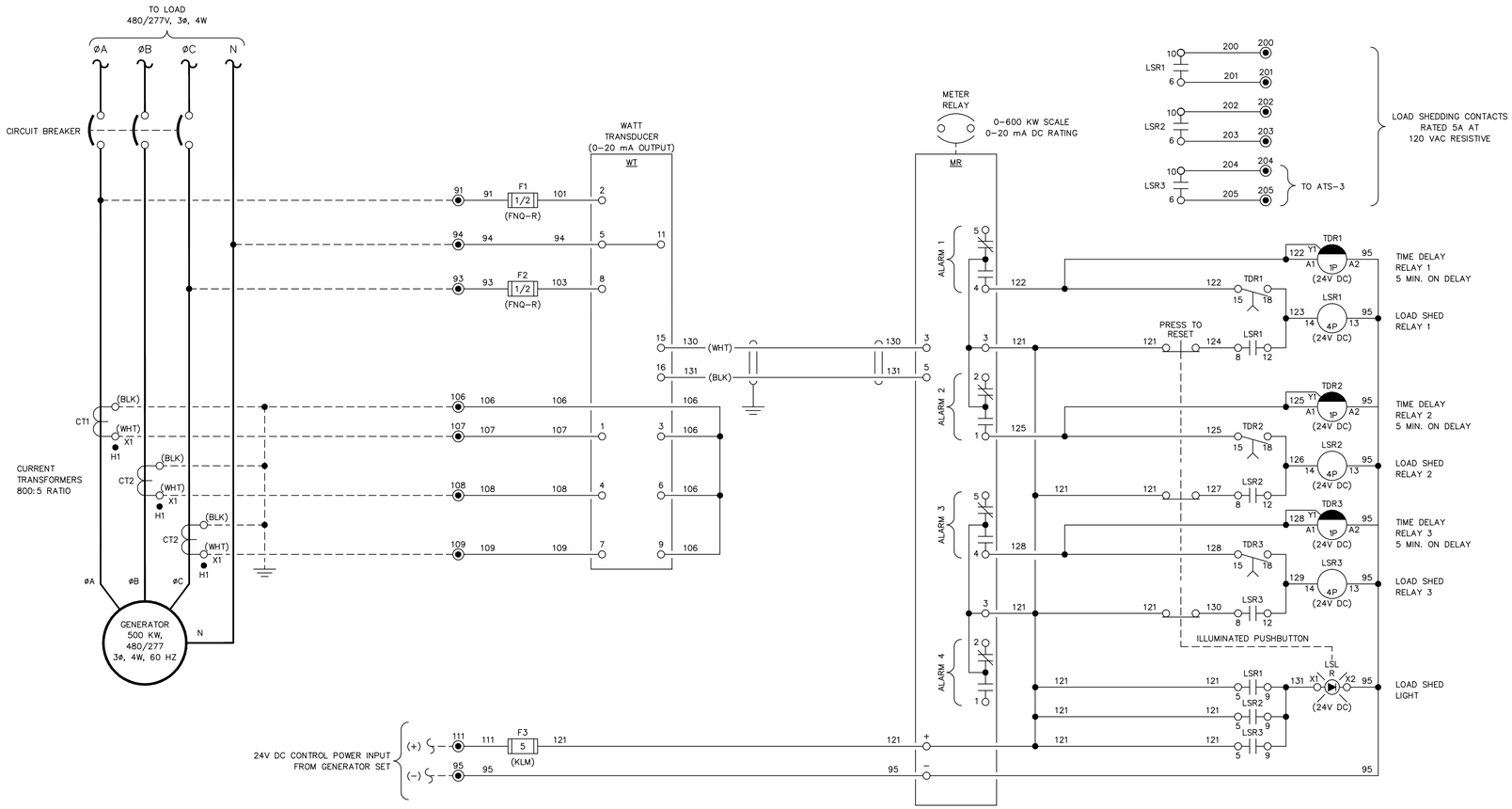
LOAD SHEDDING PANEL FRONTAL OUTLINE

ENCLOSURE: NEMA 1, SURFACE MOUNT

NOMINAL 16”H x 16”W x 8”D

BILL OF MATERIAL

DESCRIPTION	MANUFACTURER	PART No.
(1) ENCLOSURE, 16”H x 16”W x 8”D	RITTAL	WM16160BNC
(1) 1/4 TURN PLASTIC HANDLE	RITTAL	2533.000
(1) METER RELAY, 0–600 KW SCALE, 0–20 mA MOVEMENT, 24V DC POWER	CROMPTON	262–300
(2) RELAY MODULES, 2–POINT	CROMPTON	262–RLY
(1) WATT TRANSDUCER, 3ø, 4W, 480/277V DIRECT INPUT, 800:5 CT, 0–20 mA OUTPUT, 20 mA = 600 KW	CROMPTON	256–TWNU–QYHF–C6–SJ
(3) CURRENT TRANSFORMERS, 800:5 RATIO	ITI	8RL–801
(15) TERMINAL BLOCKS	PHOENIX	UK5N, 3004362
(1) TERMINAL BLOCK END SECTIONS	PHOENIX	3003020
(3) TERMINAL BLOCK END CLAMPS	IDEC	BNL6
(2) FUSES, 1/2A, 600 V	BUSSMANN	FNQR–1/2
(2) FUSEHOLDERS, 1 POLE	SHAWMUT	USCC1–I
(3) LOAD SHED RELAY, 24V DC, 4 POLE	IDEC	RU4S–D–D24
(3) RELAY SOCKET	IDEC	SY4S–05
(3) RELAY CLIP	IDEC	SY4S–51F1
(1) LOAD SHED LIGHT/RESET, 24V DC, RED	IDEC	HWL–M1F03QD–R–24
(3) TIME DELAY, ON DELAY, 24V DC	CARLO GAVAZZI	DMB51CM24



SCHEMATIC WIRING DIAGRAM

NOTES:
1. CONSTRUCTION: CODE GAUGE SHEET STEEL, NEMA 1, INDOOR ENCLOSURE. LISTED FOR CONFORMANCE TO UL508A
   A. PANEL SHALL BE FRONT ACCESSIBLE FOR INSTALLATION AND MAINTENANCE
   B. FINISH: RAL 7035
2. SHIPPING WEIGHT: 45 LBS.
3. INTERNAL WIRING CONNECTIONS TO BE #14 AWG MINIMUM, TYPE SIS RATED 600 VOLTS, 90 DEGREE C.
4. SCHEMATIC IS SHOWN AS FOLLOWS:
   – ALL AC POWER REMOVED
5. ⦿ INDICATES TERMINALS IN LOAD SHEDDING PANEL
6. – – – INDICATES FIELD INTERCONNECTION WIRING. ALL WIRING TO CONFORM TO LOCAL CODES

REV	DATE	CHECKED
A	02-25-09	DMJ

Cummins Northwest, LLC

1905 E. CENTRAL AVE. YAKIMA, WA 98901
PH. (509) 248–9033 * FAX (509) 457–8953

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DRAWING: THREE POINT LOAD SHEDDING CONTROL PANEL 500 KW, 480/277V

PROJECT: BATTELLE BSF/CSF BUILDING

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED

SHEET 1 OF 1 | SCALE: NONE

		DATE
DESIGNED	DMJ	02-24-09
CHECKED	DBB	02-24-09
DRAFTED	DMJ	02-24-09

DRAWING NO. 09-1406-1

REV. A

PowerCommand®
Remote Annunciator Panel
(LonWorks System annunciator)

> Specification sheet

Our energy working for you.™

Power Generation

Description

The PowerCommand® Network Annunciator is a network component that provides remote system status indication for emergency and other power systems in compliance to the requirements of NFPA 110. The network annunciator may also be used for remote indication of any condition that is monitored by a PowerCommand Network.

The Network Annunciator reduces installation costs and improves design flexibility by use of a PowerCommand Network to transmit all the genset and transfer switch system signals rather than using relay contacts for this purpose.

Control power for PowerCommand Network products is usually derived from the genset starting batteries. The control functions over a voltage range from 8 VDC to 35 VDC.

Features

- Visual indication of 20 network conditions and network status.
- Audible indication of any network condition - Annunciator also includes pushbutton switch to silence the audible alarm. Alarm horn sound level is approximately 90 dB(A) at 30 cm.
- Standard NFPA 110 label, field configurable for other alarm and status conditions.
- Configurable for compliance to NFPA 99 requirements.
- Sealed membrane panel design provides environmental protection for internal components and is easy to clean.
- Warranty - PowerCommand Controls are supported by a worldwide network of independent distributors who provide parts, service and warranty support.
- UL Listed and labeled; CSA certified; CE marked.
- Wall mount NEMA 1 enclosure or flush mount configurations available.

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S-1343e (9/07)

Specifications

Signal requirements

Network connections: Echelon® LonWorks®, twisted-pair 78 kbps, FT-10.

Control power: 8-30 VDC, 3.5 W (maximum) 0.8 W typical.

Wiring materials for network signals are UL Listed 4 twisted pair wiring. Terminations for control power accept wire up to 16 ga.

Environment

The annunciator is designed for proper operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and for storage from -40 °C to +80 °C (-40 °F to +176 °F). Control will operate with humidity up to 95%, non-condensing and at altitudes up to 5000 m (13,000 ft).

Alarm Horn

Sound Level: 90 dB(A) at 30 cm

Physical

Weight: 1.45 kg (3.2 lbs) (board plus enclosure)

Power

Maximum Consumption: 5 W
Standby Consumption: 0.4 W or less
Network Length: Maximum 1400 m (4600 ft), when using NEMA Level 4 cable

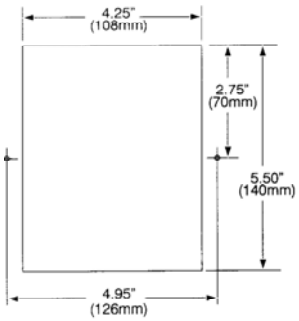
Self-binding configurations - Supports use of up to four annunciators with up to one genset and one transfer switch.

Maximum wire lengths - control power-self-binding system

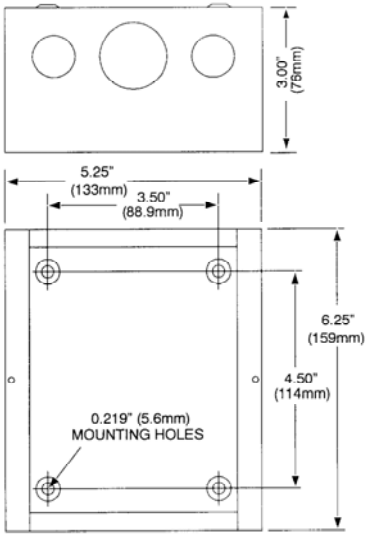
Wire size	12 VDC	24 VDC
22 ga	100 m (330 ft)	338 m (1100 ft)
20 ga	158 m (520 ft)	537 m (1760 ft)
18 ga	250 m (820 ft)	852 m (2790 ft)
16 ga	398 m (1300 ft)	1352 m (4430 ft)
14 ga	631 m (2070 ft)	1400 m (4600 ft)

Dimensions

Cut out detail (without enclosure)



Annunciator enclosure



Dimensions: in (mm)

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S-1343e (9/07)

Label configurations & standard bindings

NFPA 110 genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- High battery voltage (A)
- Low battery voltage (A)
- Genset running (G)
- Genset supplying load (G)
- Pre-low oil pressure (A)
- Low oil pressure (R)
- Pre-high coolant temperature (A)
- High coolant temperature (R)
- Low engine temperature (A)
- Overspeed (R)
- Fail to start (overcrank) (R)
- Not in auto (R)
- Battery charger malfunction (A)
- Low fuel (A)
- Low coolant level (R)
- Spare (4) (G)
- Common alarm

(A) = Amber; (R) = Red; (G) = Green

Extended genset alarm and status annunciator

The following conditions are provided as standard on the annunciator:

- Check genset (R)
- Ground fault (A)
- High AC voltage (R)
- Low AC voltage (R)
- Under frequency (R)
- Overload (R)
- Over current (R)
- Short circuit (R)
- Reverse KW (R)
- Reverse kVAR (R)
- Fail to sync (A)
- Fail to close (R)
- Load demand (G)
- Genset CB tripped (R)
- Utility CB tripped (R)
- Emergency stop (R)
- Spare (4) (G)

(A) = Amber; (R) = Red; (G) = Green

8-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- High/low engine temp (G)
- Low oil pressure (A)
- Low coolant level (R)
- Low fuel level (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

4-Point (genset)

The following conditions are provided as standard on the annunciator:

- Check genset (A)
- Genset supplying load (A)
- Genset running (G)
- Not in auto (G)
- Spare (16) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS-extended

This annunciation set is often used with PLT-series equipment. The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Check ATS (R)
- ATS not in auto
- Test/exercise
- Transfer pending
- Load shed
- Transfer inhibit
- Fail to close
- Fail to disconnect
- Fail to synchronize
- Low battery-controller
- Low battery-network

(A) = Amber; (R) = Red; (G) = Green

ATS 8-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 1 connected (G)
- Source 2 connected (G)
- Common alarm (A)
- Not in auto (R)
- Test/exercise mode (A)
- Low control battery (A)
- Spare (8) (G)

(A) = Amber; (R) = Red; (G) = Green

ATS 4-point

The following conditions are provided as standard on the annunciator:

- Source 1 available (G)
- Source 2 available (G)
- Source 2 connected (G)
- Source 1 connected (G)

(A) = Amber; (R) = Red; (G) = Green

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S-1343e (9/07)

Custom alarm configuration

#	Color (R/Y/G)	Label	Horn (Y/N)	#	Color (R/Y/G)	Label	Horn (Y/N)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Ordering information

Part number	Description
0541-0814-01	Network annunciator, open construction, for panel mounting
0541-0814-02	Network annunciator including control box for surface wall mounting

See your distributor for more information.

Cummins Power Generation

Americas
1400 73rd Avenue N.E.
Minneapolis, MN 55432 USA
Phone: 763 574 5000 USA
Fax: 763 574 5298

Europe, CIS, Middle East and Africa
Manston Park Columbus Ave.
Manston Ramsgate
Kent CT 12 5BF United Kingdom
Phone 44 1843 255000
Fax 44 1843 255902

Asia Pacific
10 Toh Guan Road #07-01
TT International Tradepark
Singapore 608838
Phone 65 6417 2388
Fax 65 6417 2399

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S-1343e (9/07)

CALIFORNIA DYNAMICS CORPORATION
5572 ALHAMBRA AVE.
LOS ANGELES, CA. 90032-3106

CALL US – TO SET THINGS RIGHT
FAX (323) 223 – 7941
PH (323) 223 – 3882
email: caldyn@earthlink.net

TYPE RJSD

ISOLATOR/RESTRAINT

PERFORMANCE RATED

FILE 293 11/26/01

JOB: Battelle BSF/CSF Bldg

CUST:

ENG'R:

TAG:

DEF'L:

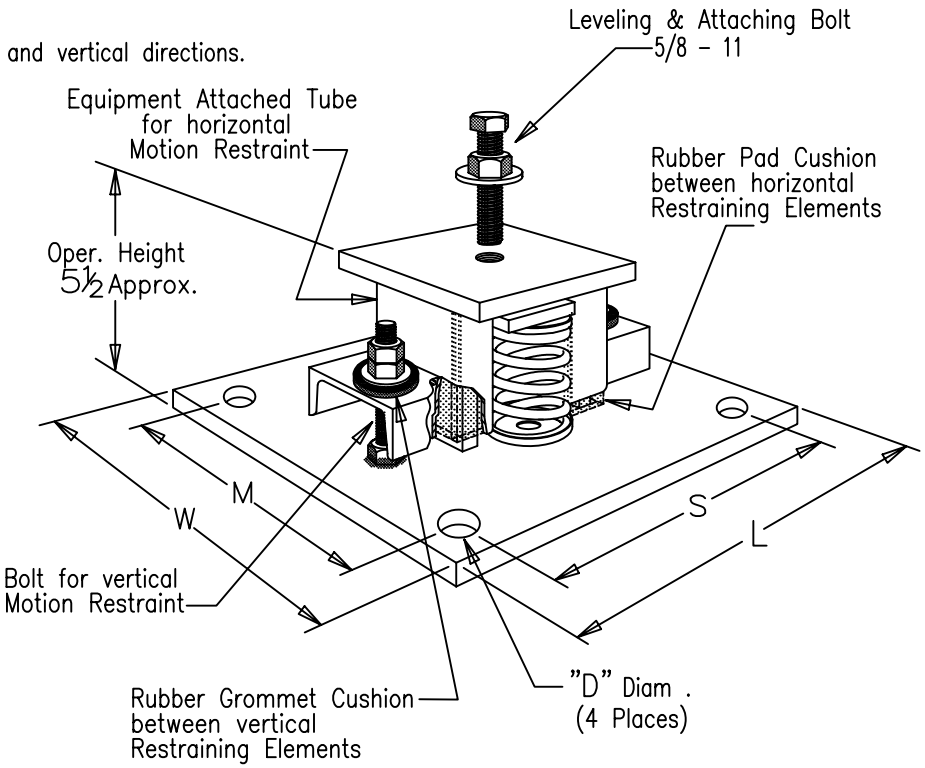
DATE:

RESTRAINT PERFORMANCE

Equipment motion is limited in all horizontal and vertical directions.

PROTECTION FOR

- Earthquakes
- Windloads
- Marine installations
- Mobile installations
- Equipment weight change due to drainage
- Unstable installations due to high equipment center of gravity



RESTRAINT CHARACTERISTICS	
Ratings	(Lbs)
Up restraint	5856
End restraint	5600
Side restraint	3666

Restraint ratings determined by independent laboratory test.

VIBRATION ISOLATION CHARACTERISTICS

Type	Max. Load (lbs)	Max. Defl. (in)	Spring Rate (lbs/in)
RJSD	42K	1 . 13	36
RJSD	110K	1 . 13	98
RJSD	158K	1 . 13	140
RJSD	212K	1 . 13	188
RJSD	240K	2 . 30	104
RJSD	310K	2 . 00	155
RJSD	402K	1 . 70	236
RJSD	488K	1 . 13	432
RJSD	592K	1 . 60	370
RJSD	636K	1 . 13	562
RJSD	790K	1 . 80	440
RJSD	1022K	1 . 50	682
RJSD	1430K	1 . 30	1100
RJSD	1602K	1 . 00	1602
RJSD	2120K	1 . 00	2120
RJSD	3040K	. 78	3900
RJSD	3920K	. 78	5030

BASE PLATE DESIGNATION	DIMENSION (inches)				
	L	S	W	M	D
7855	10	8½	7½	6	⅝
7856	10	8½	9	7½	¾
7857	12	10	10½	9	⅞

BASE PLATE DESIGNATION MUST BE INCLUDED IN CALLOUT

TYPICAL CALLOUTS

RJSD 1022K 7855
(Minimum base size for use with 1/2 inch anchors).

RJSD 3040K 7857
(Maximum base size to accomodate 3/4 inch anchors).

This rugged spring isolator provides excellent vibration protection for medium & high speed machines installed on grade. Earthquake protection is also provided by means of cushioned, rugged, motion restraining elements manufactured with ideal clearances for maximum vibration isolation efficiency and earthquake protection.

CALDYN
CALIFORNIA DYNAMICS CORP.
5572 ALHAMBRA AVENUE
LOS ANGELES, CA 90032
PHONE: (323) 223 3882
FAX: (323)223 7941

SAID AMIR SOLAIMANY
STATE OF WASHINGTON
37744
REGISTERED
PROFESSIONAL ENGINEER

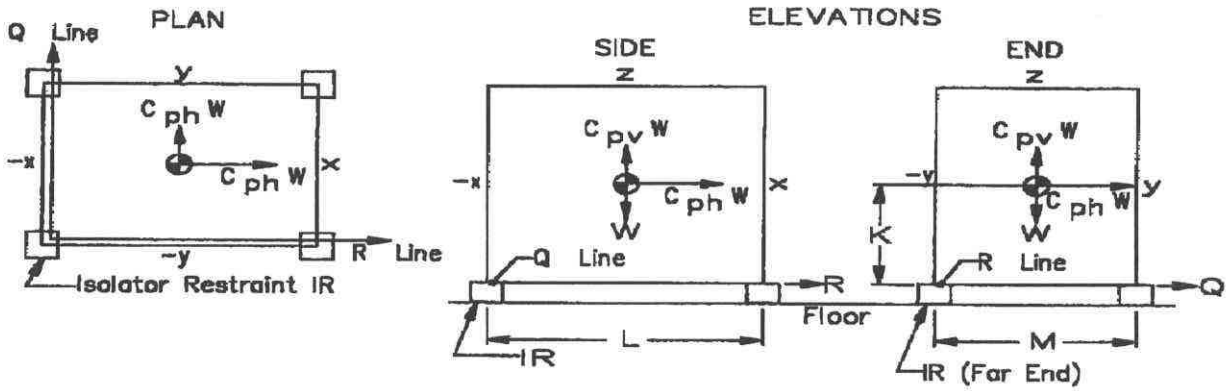
EXPIRES 10-18-09

STRUCTURAL INTEGRITY OF RESTRAINING ELEMENTS FOR EARTHQUAKE PROTECTION
PART 1: ISOLATOR RESTRAINT

Date :	2/10/2009			Isolator Restraint :	RJSD 2120-K7855
Job Name :	BATTELLE BSF/CSF BLDG.			Deflection, in. :	1
Customer :	CUMMINS NORTHWEST, LLC			Restraint quantity :	6
Equipment Tag :	500DFEK GENSET			X-Rating, lbs :	5,600.00
Weight, lbs :	9,780.00			Y-Rating, lbs :	3,666.00
Code :	IBC 2006	Horizontal Cph :	0.26	Z-Rating, lbs :	5,856.00
		Vertical Cpv :	0.1	Rating Basis :	INDEPENDENT LAB. TEST

Remarks/ Detail:

SCHEMATIC OF EQUIPMENT



LENGTH (L), in.	VERT. C.G (K), in.	WIDTH, (M), in.
96.3	21.9	56.1

Safety Factors > 1.0

Horizontal X-X Shear Load (Cph x W) (0.26 x 9780) = 2542.8

X-X Load = Load / Restraint = (2542.8/6) = 423.8 X-X Rating/ X-X Load = 5600 / 423.8 = **13.21**

Horizontal Y-Y Shear Load (Cph x W)

Y-Y Load = Load / Restraint = (2542.8/6) = 423.8 Y-Y Rating/ Y-Y Load = 3666 / 423.8 = **8.65**

Vertical pullout at IR along the Q Line quantity of Restr on Q Line, q = 2

Uplift, ((Cpv x W) / T)	(0.1 x 9780) / 6 =	163
Pri Overturn (Cph x W x K) / (L x q)	(0.26 x 9780 x 21.9) / 96.3 x 2 = +	289
	Pullout Load	452
	Pullout Rating/ Pullout Load = 5856 / 452.13 =	**12.95**

Vertical Pullout at IR along the R Line quantity of Restr on R Line, r = 3

Uplift, ((Cpv x W) / T)	(0.1 x 9780) / 6 =	163
Pri Overturn (Cph x W x K) / (M x r)	(0.26 x 9780 x 21.9) / (56.1 x 3) = +	331
	Pullout Load	494
	Pullout Rating/ Pullout Load = 5856 / 493.88 =	**11.86**

Calcs_I.D. :

CALDYN
CALIFORNIA DYNAMICS CORP.
5572 ALHAMBRA AVENUE
LOS ANGELES, CA 90032
PHONE: (323) 223 3682
FAX: (323)223 7941

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EXPIRES 10-18-09

STRUCTURAL INTEGRITY OF RESTRAINING ELEMENTS FOR EARTHQUAKE PROTECTION

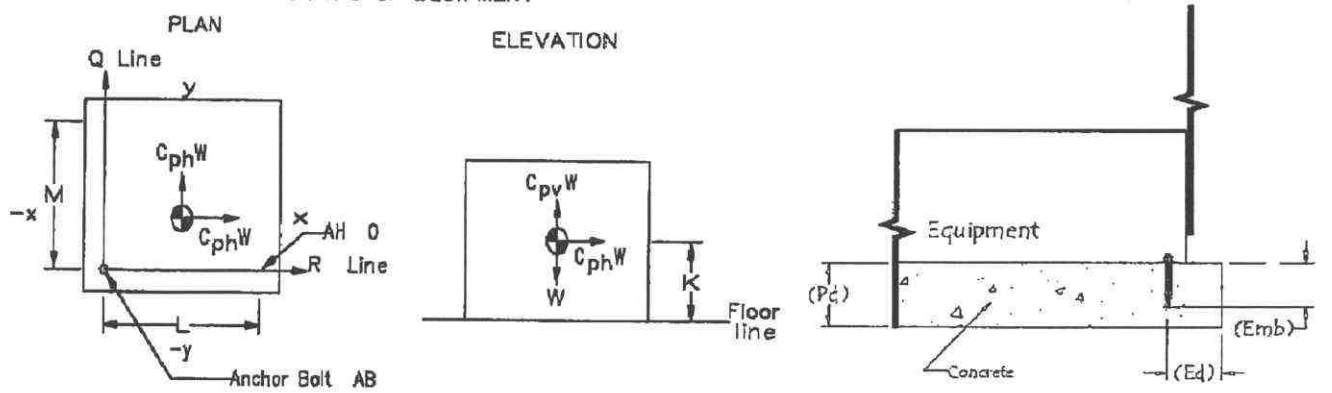
ANCHORS

DATE : 2/10/2009
JOB NAME : BATTELLE BSF/CSF BLDG.
CUSTOMER : CUMMINS NORTHWEST, LLC
EQUIPMENT TAG : TANK TO PAD
WEIGHT, lbs : 30,000.00
CODE : IBC 2006
Remarks/ Detail:

HORIZONTAL, ACph : 0.21
VERTICAL, ACpv : 0.10

ANCHORAGE : HILTI KB TZ
ANCHOR SIZE : 3/4"
SPECIAL INSPECTION : YES
ANCHOR QTY : 10
TENSION, lbs : 4,272.00
SHEAR, lbs : 6,313.00
RATING BASIS : ICC ESR-1917
SUBSTRATE : NORM. WT. CRACKED CONC.
SUBSTRATE RATING, psi : 3000 PSI

SCHEMATIC OF EQUIPMENT



(K), in.	(L), in.	(M), in.
38	221	75

(Emb), in.	(Ed), in.	(Pd), in.
4-3/4"	9"	8"

Horizontal Shear Load (ACpH x W) — ** Safety Factors > 1.0

Shear Load = 0.21 x 30000 = 6300 Shear Load/AnchorQty = 6300/10 = 630 Shear Rating/Shear Load = 6313/630 = **10.02**

Vertical Pullout at Anchor AB Resulting From X-X Load

Uplift ((W/T) x (ACpV-0.9))	((0.1-0.9) x (30000 / 10) =	-2,400.00
Pri Overturn (ACph x W x K) / (L x q)	(0.21 x 30000 x 38) / (221 x 2) = +	541.63
	Pullout Load =	-1,858.37
	Pullout Rating / Pullout Load, (4272 / -1858.37) =	(Neg OK)

Vertical Pullout at Anchor AB Resulting From Y-Y Load

Uplift ((W/T) x (ACpV-0.9))	((0.1-0.9) x (30000 / 10) =	-2,400.00
Pri Overturn (ACph x W x K) / (M x r)	(0.21 x 30000 x 38) / (75 x 5) = +	638.40
	Pullout Load =	-1,761.60
	Pullout Rating / Pullout Load, (4272 / -1761.6) =	(Neg OK)

Sum of Reciprocals of Shear and Pullout Safety Factors (1/10.02) + (Neg Set = 0) = **0.10**

COMBINED LOADING to be less than 1.00 (1/10.02) + (Neg Set = 0) = **0.10**

Calc_I.D. :

NRG

Intelligent Engine Start Battery Charger

The Smart Choice for Mission-Critical Engine Starting

- **Fast, accurate, mission-critical charging** – gives best starting reliability
- **Replace nearly any charger** – without planning ahead
- **Industry-first battery-fault alarm** - helps dispatch service early
- **1 million hour observed MTBF** – means longest charger life
- **Smart design** – stops load dump and other damaging transients

ISO 9000 c UL us LISTED CE

SENS®
Our energy means business®

www.sens-usa.com • info@sens-usa.com • Toll-free 866.736.7872 • 303.678.7500

NRG Battery Charger Benefits and Features

Failure to start due to battery problems is the leading cause of inoperable engine generator sets.

SENS NRG battery charger maximizes starting system reliability while slashing genset servicing costs:

One NRG replaces almost any charger without extra site visits. Installers can select or change at any time 120, 208 or 240 volts AC input, 12 or 24-volt battery and output settings optimized for nearly any lead-acid or nickel cadmium battery.

Easy to understand user interface provides state-of-the-art system status – including digital metering, NFPA 110 alarms and a battery fault alarm that can send service personnel to the site before failure to start.

Batteries charged by NRG give higher performance and last longer. In uncontrolled environments precision charging by SENS increases battery life and watering intervals 400% or more.

NRG meets all relevant industry standards – including UL, NFPA 110 and CE. All units are either C-UL listed or C-UL recognized. 50/60 Hz units add CE marking to UL agency marks.

***EnerGenius* reliability technology built into every charger includes:**

- All-electronic operation with generous component de-rating
- Disconnected/reversed/incorrect voltage battery alarm and protection
- Protection of connected equipment against load dump transients
- Widest temperature rating, and overtemperature protection
- Superior lightning and voltage transient protection
- Demonstrated field MTBF > 1 million hours
- Standard 3-year warranty and available reimbursement of customer field service costs

Earn the best return on your charger investment – choose SENS NRG

NRG Specifications

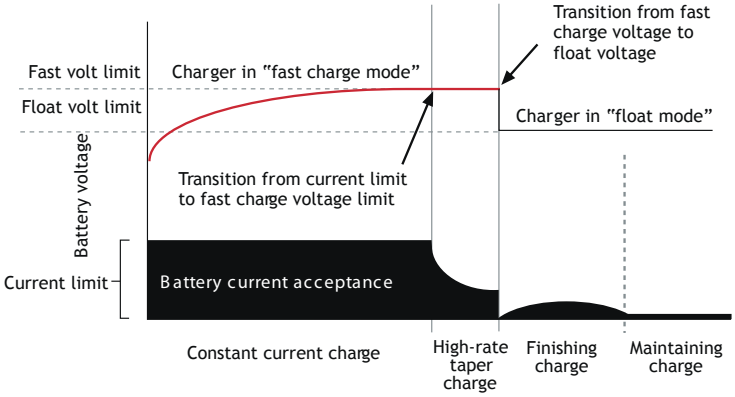
AC Input

Voltage	110-120/208-240 VAC, ±10%, single phase, switch selectable
Input current	10A charger: 6.6/3.3 amps maximum 20A charger: 12.6/6.3 amps maximum
Frequency	60 Hz ±5% standard; 50/60 Hz ±5% optional
Input protection	1-pole fuse, soft-start, transient suppression

Charger Output

Nominal voltage ratings	12 or 24 volt nominal
Optional voltage rating	12/24 volt, field selectable
Battery settings	Six discrete battery voltage programs - Low or high S.G. flooded - Low or high S.G. VRLA - Nickel cadmium 9, 10, 18, 19 or 20 cells
Regulation	±0.5% (1/2%) line and load regulation
Current	10 or 20 amps nominal
Electronic current limit	105% rated output typical – no crank disconnect required
Charge characteristic	Constant voltage, current limited, 4-rate automatic equalization
Temperature compensation	Enable or disable anytime, remote sensor optional
Output protection	Current limit, 1-pole fuse, transient suppression

Standard 4-rate charging



User Interface, Indication and Alarms

Digital meter	Switch-selectable meter for output volts, amps
Accuracy	±2% volts, ±5% amps
Alarms	LED and Form C contact(s) per table:

Front panel status display

Alarm System Functions

	Alarm code "1"[1]	Alarm code "C" (meets requirements of NFPA 110)
AC good	LED	LED
Float mode	LED	LED
Fast charge	LED	LED
Temp comp active	LED	LED
AC fail	LED[2]	LED and Form C contact
Low battery volts		LED and Form C contact
High battery volts		LED and Form C contact
Charger fail	LED[2]	LED and Form C contact
Battery fault[3]	LED[2]	LED and Form C contact

1. Alarms "1" available only on 10A charger
2. Form C contact provides summary alarm of these conditions. BBHH chargers include this alarm configuration. Contacts rated 2A @ 26 VDC resistive
3. Battery fault alarm indicates these fault conditions:
   - Battery disconnected - Battery polarity reversed - Mismatched charger battery voltage - Open or high resistance charger to battery connection - Open battery cell or excessive internal resistance

Controls

AC input voltage select	Field-selectable switch
Optional 12/24-volt output select	Field-selectable two-position jumper
Battery program select	Field-selectable six-position jumper
Fast charger enable/disable	Field-selectable two-position jumper
Temp compensation enable	Standard. Can be disabled or re-enabled in the field
Remote temp comp enable	Connect optional remote sensor to temp comp port

Simple field adjustments

Environmental

Operating temperature	-20C to +60C, meets full specification to +45C
Over temperature protection	Gradual current reduction to maintain safe power device temperature
Humidity	5% to 95%, non-condensing
Vibration (10A unit)	UL 991 Class B (2G sinusoidal)
Transient immunity	ANSI/IEEE C62.41, Cat. B, EN50082-2 heavy industrial

Agency Standards

Safety	C-UL listed to UL 1236 (required for UL 2200 gensets), CSA standard 22.2 no. 107.2-M89 CE: 50/60 Hz units DOC to EN 60335
Agency marking	60 Hz: C-UL-US listed 50/60 Hz: C-UL-US listed plus CE marked
EMI	FCC Part 15 Class B; EN 50081-2
NFPA standards	NFPA 70, NFPA 110. (NFPA 110 requires Alarms "C")
Optional agency compliance	Units with Alarms "1" configuration available with additional compliance to UL category BBHH and NFPA 20

Construction

Housing/configuration	Material: Heavy clear anodized aluminum. Configuration options: • Fully enclosed: C-UL listed enclosure • Open frame: C-UL recognized • Slimline: C-UL recognized open frame construction with remote isolation transformer
Packaging	Open-frame and Slimline configurations only available in bulk OEM quantities and packaging
Dimensions	See Drawings and Dimensions page for details
Printed circuit card	Surface mount technology, conformal coated
Cooling	Natural convection
Protection degree	Listed housing: NEMA-1 (IP20). Optional NEMA 3R enclosure
Damage prevention	Fully recessed display and controls
Electrical connections	Compression terminal blocks

Warranty

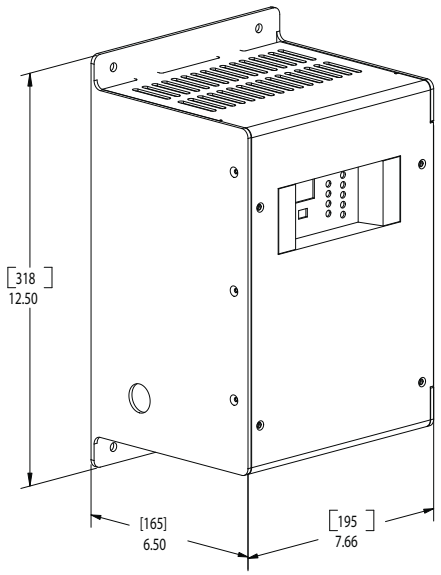
Standard warranty	Three year parts and labor warranty from date of shipment
Optional warranty	If specified at time of order, warranty coverage is increased to reimburse customer's documented field service costs up to the original charger price. Contact the factory for full details

Optional features

Input	Input frequency, 50/60 Hz
Remote temp comp sensor	Recommended where battery and charger are in different locations
Drip shield	Protects from dripping water
NEMA 3R housing	Enables outdoor installation (remote temp sensor recommended)
UL BBHH listing	Available in 10A units with Alarms "1"
Field service warranty	Reimbursement of customer field service expenses up to charger price

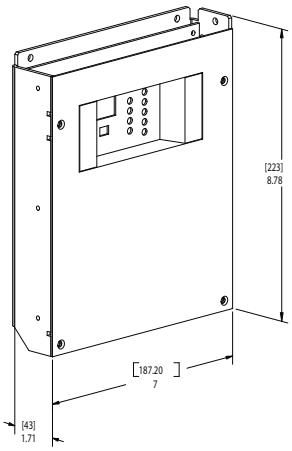
Drawings and Dimensions

10A Chargers
Enclosed and Open Frame Configurations

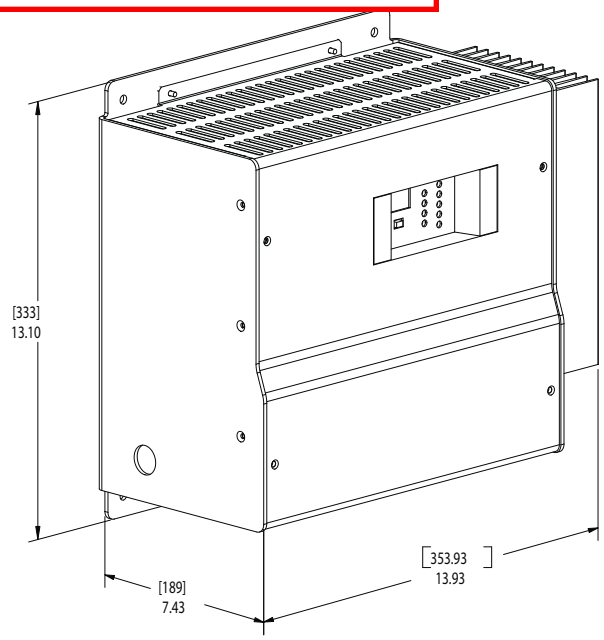


Open-frame configuration omits front cover

10A Chargers
Slimline Open Frame Configuration



Slimline can be mounted either flat or edgewise



20A Chargers
Enclosed and Open Frame Configurations

Open-frame configuration omits front cover

Housing Dimensions Table

Amps	Configuration	Width	Depth	Height
10	Enclosed	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Open-frame	7.66" (195 mm)	6.50" (165 mm)	12.50" (318 mm)
10	Slimline – flat mount	7.00" (187 mm)	1.71" (43 mm)	8.78" (223 mm)
10	Slimline – edge mount	1.71" (43 mm)	7.00" (187 mm)	8.78" (223 mm)
20	Enclosed	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)
20	Open-frame	13.93" (354 mm)	7.43" (189 mm)	13.10" (333 mm)

NRG Ordering Information

Output volts	Output amps	Model	Available configurations	NFPA 110 Alarms	Lbs/Kg
12	10	NRG12-10-R1	Enclosed, Open-frame, Slimline	No	19 / 8.7
12	10	NRG12-10-RC	Enclosed, Slimline	Yes	19 / 8.7
24	10	NRG24-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
24	10	NRG24-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12/24	10	NRG22-10-R1	Enclosed, Open-frame, Slimline	No	24 / 10.9
12/24	10	NRG22-10-RC	Enclosed, Slimline	Yes	24 / 10.9
12	20	NRG12-20-RC	Enclosed, Open-frame	Yes	39 / 17.7
24	20	NRG24-20-RC	Enclosed, Open-frame	Yes	42 / 19.1
12/24	20	NRG22-20-RC	Enclosed, Open-frame	Yes	42 / 19.1

All models offer field-selectable input 120/208-240 volts. 60 Hz input is standard with C-UL listing. Optional 50/60 Hz input includes C-UL listing and adds CE mark.

Model Number Breakout

Model

Output voltage
- 12: 12 volts
- 24: 24 volts
- 22: 12/24-volt field selectable

Output current
- 10: 10 amps
- 20: 20 amps

AC input
- R: 120/208-240 VAC, 60 Hz
- H: 120/208-240 VAC, 50/60 Hz

Alarm system code
- 1: LED and single Form C contact
- C: LEDs and Form C contacts to meet NFPA 110

Housing/Agency
- L: Enclosed: C-UL listed
- R: Open-frame: C-UL recognized
- S: Slimline open-frame: C-UL recognized (10A only)

UL category code
- S: UL category BBGQ (standard)
- H: UL category BBHH (Alarms "1" only)

The Smart Choice for Mission-Critical Engine Starting

Additional Information

Contact SENS or your local sales representative for additional specification, engineering and installation information

ISO 9000 c UL US LISTED CE

Contact Information

For information and service on any SENS product, please contact us at:
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www.sens-usa.com • info@sens-usa.com
1840 Industrial Circle, Longmont, CO 80501 USA

SENS®
STORED ENERGY SYSTEMS
Our energy means business®

INTERSTATE BATTERIES

SUGGESTED CUSTOMER PRICES -- ALL PRICES QUOTES ARE EXCHANGE

BCI Group Size	Interstate Batteries Type	SAE Ratings		Comparative Ratings Only		VOLTAGE	STOCK NO. (1)	Free Replacement Months	SERVICE ADJUSTMENT			
		CCA 30 Ssec. at 0° F	Reserve Capacity(4)	32° F CA	80° F HCA				Non-Commercial (2)		Commercial (3)	
									Months	Cost/Mo.	Months	Cost/Mo.
COMMERCIAL (2) 12 VOLT												
4D	4D-XHD	1000	295	1250	1440	12	59001	6			36	4.36
4DLT	4DLT-VHD	850	250	1065	1225	12	5988	6			30	4.70
8D	8D-MHD	1400	450	1750	2015	12	59811	6			36	5.28
8D	8D-XHD	1155	380	1445	1665	12	59411	6			36	5.11
8D	8D-P30	1155	380	1445	1665	12	59121	6			36	5.64
29H	29H-VHD	660	160	825	950	12	5965	18			36	2.64
29NF	29NF-VHD	420	77	525	605	12	5974	6			36	2.22
31	31-MHD	950	195	1190	1370	12	5917	18			36	3.17
31	31P-MHD	950	195	1190	1370	12	5917	18			36	3.17
31	31-LHD	750	180	940	1080	12	5916	18			36	2.86
31	31P-LHD	750	180	940	1080	12	5916	18			36	2.86
31	31-VHD	660	160	825	950	12	5965	18			36	2.64
31	31-DC	700	200	875	1010	12	5917	18			36	3.17
24	C24-XHD	575	130	720	830	12	5994	18	60	1.35	30	2.70
24F	C24F-XHD	575	130	720	830	12	5994	18	60	1.35	30	2.70
27	C27-XHD	675	160	845	970	12	5945	18	60	1.47	30	2.93
27F	C27F-XHD	675	160	845	970	12	5945	18	60	1.47	30	2.93
50	C50-XHD	600	108	750	865	12	5917	18	60	2.00	30	4.00
65	C65-XHD	650	115	815	935	12	5926	18	60	1.67	30	3.33
74	C74-XHD	575	130	720	830	12	5915	18	60	1.40	30	2.80
75U	C75CT-XHD	575	100	655	755	12	5925	18	60	1.42	30	2.83
78U	C78DT-XHD	725	120	905	1045	12	5966	18	60	1.84	30	3.67
N100	N-100	750	180	925	1080	12	5997	6			24	5.54
N120	N-120	620	240	775	840	12	59901	6			24	8.29
N120	N120	800	250	975	1150	12	59131	6			24	9.12
NS150	NS150	800	275	975	1150	12	59991	6			24	13.93
3EE	U3EE-VHD	450	100	500	575	12	5905	6			30	2.83
3ET	U3ET-VHD	500	140	575	660	12	5985	6			30	3.26
16TF	USRM-16TF	640	250	800	920	12	59501	6			30	5.52
17TF	U17TF-VHD	625	150	665	765	12	5947	6			30	4.00
53	U53K-VHD	360	65	450	520	12	5994	6			30	2.77
60K	U60K-VHD	550	105	690	790	12	5985	6			30	3.27
6TN	U6TL	825	215	1030	1180	12	5939	6			30	5.20